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October, 1944

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PUBLISHED MONTHLY BY EDISON ELECTRIC INSTITUTE

THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

July, 1943 and 1944

SOURCE AND DISPOSAL OF ENERGY—MONTH OF JULY

	1944	1943	%
GENERATION* (Net)			
By Fuel Burning Plants	12,980,531,000	12,450,767,000	+ 4.3
By Water Power Plants	5,991,079,000	6,206,858,000	− 3.5
Total Generation	**18,971,610,000**	**18,657,625,000**	**+ 1.7**
Add—Net Imports over International Boundaries	149,504,000	154,185,000	− 3.0
Less—Company Use	130,675,000	140,660,000	− 7.1
Less—Energy Used by Producer	452,394,000	820,462,000	−44.9
Net Energy for Distribution	**18,538,045,000**	**17,850,688,000**	**+ 3.9**
Losses and Unaccounted for	2,493,510,000	2,452,308,000	+ 1.7
Sales to Ultimate Customers	**16,044,535,000**	**15,398,380,000**	**+ 4.2**

CLASSIFICATION OF SALES

NUMBER OF CUSTOMERS—As of July 31st			
Residential or Domestic	27,222,305	26,814,972	+ 1.5
Rural (Distinct Rural Rates)	1,142,676	1,082,535	.....
Commercial or Industrial:			
Small Light and Power	4,211,430	4,156,755	+ 1.4
Large Light and Power	150,133	146,676	
Other Customers	116,174	117,025	.....
Total Ultimate Customers	**32,842,718**	**32,317,963**	**+ 1.6**
KILOWATTHOUR SALES—During Month of July			
Residential or Domestic	2,402,683,000	2,233,348,000	+ 7.6
Rural (Distinct Rural Rates)	304,034,000	332,771,000	− 8.6
Commercial or Industrial:			
Small Light and Power	2,473,614,000	2,380,649,000	+ 3.9
Large Light and Power	9,394,537,000	8,912,199,000	+ 5.4
Street and Highway Lighting	149,455,000	143,372,000	+ 4.2
Other Public Authorities	679,644,000	750,923,000	− 9.5
Railways and Railroads:			
Street and Interurban Railways	352,201,000	356,689,000	− 1.3
Electrified Steam Railroads	212,426,000	208,892,000	+ 1.7
Interdepartmental	75,941,000	79,537,000	− 4.5
Total to Ultimate Customers	**16,044,535,000**	**15,398,380,000**	**+ 4.2**
Revenue from Ultimate Customers	**$265,765,100**	**$252,982,600**	**+ 5.1**

RESIDENTIAL OR DOMESTIC SERVICE

AVERAGE CUSTOMER DATA—For 12 months ended July 31st			
Kilowatthours per Customer	1,122	1,050	+ 6.9
Average Annual Bill	$39.83	$38.12	+ 4.5
Revenue per Kilowatthour	3.55¢	3.63¢	− 2.2

(*) By courtesy of the Federal Power Commission.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 12 OCTOBER, 1944 No. 10

The Excess Profits Tax

With Particular Reference to Its Effects on Electric Utility Companies

By C. W. Kellogg

President, Edison Electric Institute

Presented before the Indiana Electric Association, French Lick, Ind., Sept. 21, 1944

THE effect of the excess profits tax provisions of the Federal Revenue Act on the electric utilities has been not only injurious to them but unfairly so. For the record, I shall first state what these adverse repercussions have been; but my discussion will be confined principally to the threat of rate reductions.

"Excess Profits" a Misnomer

1. The primary difficulty, from which all the others flow, is the non-realistic basis, so far as electric utilities are concerned, which the Revenue Act provides for the computing of excess profits. By failing to allow fully for the charges on the additional utility plant required to produce the additional revenue earned by utilities in any year over those of the base period, the very name "excess profits" becomes a misnomer so far as the utilities are concerned. This is especially the case with an industry which, like the utilities, has such a high ratio between investment and revenue. With the average well-developed industrial concern, fixed charges on plant investment are a relatively small item in total costs (about 1.67 per cent in 1943); but with the utilities such charges now total 25 per cent of the total cost of doing business.

Government Competition

2. In connection with steep additions to the rates in other brackets of corporate taxation, the excess profits tax has raised total utility taxes to a level where the exemption from Federal taxes, enjoyed by governmentally owned utilities, makes their competitive position, compared to taxpaying utilities, a very threatening one. Five years ago, when Federal taxes took but 5 per cent of operating revenue, skillful management could easily overcome the handicap; but today, when they take over three times as large a proportion of revenue, the margin between business management and political management becomes much more difficult to overcome by the greater efficiency of the former.

Rate Reduction

3. Some regulatory bodies have maintained that in utility rate cases excess profits taxes should not be allowed as a part of the cost of operation, even though such taxes cost real money, just like payroll, coal or interest charges. Latterly, the proposition has been advanced by some public bodies that excess profits should be eliminated by the simple device of reducing rates, and that this should be done regardless of its obvious effect in reducing Federal revenues required to finance the war.

With this brief statement of the case, let us now consider the subject as it has developed in recent months.

The general burden of war taxes is one that should be shared by every element in the country and the utilities must carry their share like every other business or individual. Except for the failure of the Act to allow fully for the special investment situation that utilities face due to their inherent nature, the utilities have recognized the impelling necessities of the demands of war and have felt that the only thing that can permanently decrease tax burdens will be the end of the war itself. The proposition of a permanent change in electric rates in order to relieve a temporary tax condition is, however, a very serious matter, requiring careful study if great damage is to be avoided.

War Financing vs. Local Relief

When this proposition of rate reduction first came up there was a substantial body of public opinion which held; that there was a war to be financed and that the principle of diverting revenues from the Federal Treasury to local citizens (through the route of special local taxes or rate reductions or customer refunds) was not only unpatriotic, but represented a policy which, if applied to all corporations, would seriously menace the financing of the war. This viewpoint received a rude jolt this past Summer when the Secretary of the Treasury announced that such loss of revenue would not be resisted by him if electric rates only were involved. The utilities have known for a number of years that under the New Deal their own government was their most determined enemy, but they did not realize that this enmity had reached a scale of vindictiveness which put them in a position lower than the external enemies of the country. However, the mere willingness of the government in this instance to trade "winning the war" for "soaking the utilities" does not dispose of the economic facts of the situation.

The matter has been complicated by the fact that some State utility commissioners have felt sincerely that the very existence of anything called "excess profits" meant that the Commission had been negligent in its work of regulating the rates of the utility which had such excess profits.

In order to try to resolve these questions, let us look at the facts. From 1939 (the last prewar year) to 1943, operating revenues of the electric utility industry increased $659 (million) and gross corporate income (the net amount available for a return on the investment) de-

creased $48 (million). During this same period, the net increase in plant investment (total expenditures, less replacements) was $1,171 (million). Seven per cent return on this added investment would be $82 (million). So the decrease in gross corporate income on a factual basis would have been 48 + 82 or $130 million. Excess profits taxes paid in 1943 were $192 (million). Consequently, the increase in net, factually computed, before any excess profits taxes, was about $62 (million). This difference represents about 2.2 per cent of the operating revenues of 1943; hence, a decrease in revenues from the rates of 2.2 per cent would theoretically wipe out any factually computed excess profits.*

This, however, does not fairly dispose of the question as a matter of permanent rate reduction. We must first examine the nature of the changes in earnings that occurred between the last prewar year (1939) and the maximum war year (1943).

War Investment Revenue Ratios Not Normal

In the first place, it is obvious from the figures just stated, showing the relationship of gain in operating revenue to the increase in net plant to be 1 to 1.78, that the nature of those increased revenues was far from normal. This ratio over the years has averaged about 1 to 5. This conclusion, based on financial data, is confirmed by physical factors. The analysis of growth in energy output from 1939 to 1943 shows that 42 per cent of it was due to increased load factor. Energy growth from this source is, from its very nature, due to war conditions and would therefore disappear as soon as peacetime conditions were restored.

Effect of War Load Factor Is Temporary

In order to translate this into earnings figures, it may be noted that between 1939 and 1943 electric utility revenues from industrial or special war plants increased $385 (million). With 42 per cent of this due solely to increase in load factor, and even assuming that the differential rate on such increase would be say one-half the average overall power rate, this means that over $80 (million) of this growth would be due to disappear automatically as soon as the press of war production ends. It will be noted that this amount, which is due for eclipse after the war, is greater than the theoretically possible rate reduction of $62 (million) indicated by the factually computed increase in profits due to the war.

Breakdown of War Revenues

In further confirmation of the temporary and abnormal nature of the fundamental ratios in the utility business, which the war has brought in its train, we have but to consider the breakdown of utility war revenues. In the last prewar year (1939) industrial power revenues comprised 26.5 per cent of the total revenues of the electric utilities. Yet in 1943, the revenues from industrial and war loads accounted for 60 per cent of the entire gain in revenues over 1939. Thus, well over one-half the gain in industrial power revenue in 1943 over 1939, or about $210 (million), was a pure war effect and therefore as temporary as the war itself.

War Effect on Industry as a Whole

Further light is cast on this subject by approaching it from the general industrial angle. As I have pointed out recently,** the figures going back for 15 years show a very close, constant relationship between the Federal Reserve Board Index of Industrial Production and the consumption of electric energy in industry. This Index in turn has been broken down by the Federal Reserve Board between war and civilian production respectively—their division for the year 1943 being: two-thirds war and one-third civilian. Moreover, the magnitude of the war index alone for that year is larger than any civilian total ever achieved in any previous year in the nation's history. This again emphasizes the temporary nature of the war power load in the underlying growth of the country.

The facts and figures I have presented seem to demonstrate that, at least for the electric utility industry as a whole, any excess profits that may have appeared during the war (whether as reported or as factually corrected for offsetting fixed charges) are solely a war phenomenon, which, based on their origin, nature and relative magnitude, will disappear with the end of the war industrial effort and would never have arisen but for the special effects produced by the war itself. That is to say, they do not represent either a normal condition or one which could have arisen, other things being equal, but for the war.

This being the case, any general reduction of rates based on current conditions would be most unfair to the utilities, since the return to relatively normal civilian conditions, which is right now beginning clearly to appear, will automatically make them inadequate to produce that fair rate of return which is needed to keep the utilities soundly able to finance the service to the public—to perform which is their sole function.

Relief Should Be as Temporary as the Conditions Requiring It

It would be idle to maintain (and I do not do so) that no "excess profits," as defined in the Revenue Act, have arisen with utility operation during the war; but we can and do maintain that, through the tax route, 90 per cent of them have been devoted to the prosecution of this greatest war of all time, not to the enrichment of stockholders. If any State regulatory commission or any local taxing body should feel that it has the duty, for the local relief of their constituents, to drain excess profits taxes away from the service of the nation in this great emergency, then the fair and factual procedure should be to do so in the form of either (1) customer refunds for a specific year, or (2) special taxes which will expire with the end of the war emergency.

Basic Relationships Change Very Slowly

Whether or not one may agree with the force of all the points that have been brought up herein, it is common knowledge that basic conditions and relationships, in as large an industry as the electric utilities, change very slowly and gradually over the years. (For example: for the fourteen years ending with 1939 the average per cent of total revenue arising from the sale of industrial power was 27.9 per cent and for the year 1939 itself it was 26.5 per cent). If, after the industrial abnormalities of the war are past, it appears that any particular utility's rates are too high or too low, they should, of course, be regulated as required by law. But to attempt fundamental rate revision under war conditions is like trying to form an accurate idea of one's true appearance from looking into a distortion mirror.

War Effect on Investors and Consumers

This plea might well fall on deaf ears if, compared to other citizens, either the utility stockholders had gained, or their customers had lost, during the war period; but just the reverse is the case.

(*Continued on page* 322)

* The actual increase reported in net income before payment of excess profits taxes) in 1943 over 1939 was, of course, $144 million, due to inadequate allowance in the Revenue Act for charges on increased investment.

** "What Have We to Sell" paper to Commercial Meeting, EEI, Chicago, April 5, 1944.

Can Business, Labor and Agriculture Co-operate Profitably in Our Free Enterprise?

By G. L. Stanton

Advertising & Publicity Director, Idaho Power Company, Boise, Idaho

An address to the Pacific Advertising Association at Fresno, Cal.

OBVIOUSLY, the answer to the question "Can Business, Labor and Agriculture Co-operate Profitably in Our Free Enterprise?" is a resounding "Yes—they have done so since the founding of the nation in 1776, and if they cannot do so after the close of this war, then Heaven help the American people!"

At the present time there is scant evidence that any of these groups believe otherwise, and all are making plans for post-war years of continued progress under the system called American free enterprise. Each group may have grievances or may suffer instances of maladjustment in the economic scheme of things—such problems are inevitable and are ultimately solved by orderly processes.

The most grave danger to proper and profitable cooperation among these three in facing the problems of returning to a peace-time economy, lies in failure to recognize common objectives and the inter-dependence of the three. This failure is no more likely to occur with one group than another. The challenge confronting the leadership of each is to recognize the rightful place of the others and help them achieve it. There is no more sorry spectacle than that of either business, labor or agriculture attempting to achieve its aims by discrediting the others. None can climb without benefiting the others, and none can fail to share the suffering of the others, if suffering exists.

This thing we call free enterprise is not the especial property of any one group—it belongs to all Americans in all walks of life. We can subscribe heartily to the statement by William Green, president of the American Federation of Labor, in the *American Federationist,* when he wrote:

"The freedom of enterprise is not the sole prerogative of the owners and managers of industry. It is a freedom shared and jealously guarded by every American worker and farmer. It is an economic freedom—the freedom of opportunity—which is just as important and just as basic in the hearts of American citizens as their political and religious freedoms."

Surely this is true of professional people, of doctors, lawyers and ministers, of people in all sorts of service industries, as well as of the three general groups under discussion today. And when we accept free enterprise as the universal heritage of Americans, we are accepting equal responsibility to improve its workings and utilize it fully and properly.

The experience of war and of the past decade and a half has had a sobering effect upon Americans. We are asking ourselves many serious questions: "What is this all about?" "Where have we been traveling?" "And where are we going?" There is a complex of bewilderment among thoughtful people, those who are not content to merely drift with the tide.

In periods of prosperity, and don't forget that war has created an abnormal prosperity far greater than we have ever achieved in peace-time, the American system seems to run smoothly, and we are not prone to criticize each other. Everyone wants to take credit for progress.

In adversity, we start tearing each other's throats—we think our system is all wrong, and no one wants to assume responsibility for the economic ills besetting us. Unfortunately, our trend for years has been to turn to government for a solution to these problems, when we should know that government has no money except what it takes from us in taxes, and otherwise is not designed to meet those problems.

There is a Biblical admonition to place first things first, and surely there can be no disagreement that the number one job for all Americans today is to cooperate wholeheartedly in the job of winning the war. Although our democratic processes may at times appear clumsy and inefficient, yet in the past 30 months we have shifted from a nation which, prior to the declaration of war, was out-doing all others in peace-time production, to a nation whose war production far exceeds that of any other nation on earth.

This great accomplishment did not merely happen—the ability to perform it was inherent in our people and dates back to qualities which have been bred into us from the day of the hardy pilgrims who landed at Plymouth Rock and who, with grim determination, hard work and sacrifice, conquered the elements and pushed the boundaries westward. They left the old world in order that they might have freedom of worship and freedom of opportunity. They were firm of faith, unafraid, yet confident of their future and the future of those to follow. They were self-reliant, yet responsive to the needs of those to whom misfortune had fallen. This country was not built by common men. In those pioneer days, men were whipped and held up to public ridicule who were too lazy or too soft to provide for themselves and their families. There was no place for the laggard except locked in stocks in public squares. There was a job to be done, and the toughness of American pioneering spirit did not countenance the shirking of responsibility, neither did it countenance shifting their responsibility to any branch of government.

Gradually over a period of many years, when primitive hardships had been overcome and the American way of life had been made easier, a more tolerant attitude became prevalent toward that segment of the public which did not choose to be hard-working and thrifty. In the pioneer days the idea of relief was applied to unfortunate people on an emergency basis, but the idea of extending relief beyond the period of an emergency was unheard of. Those pioneers knew well that to go beyond the relieving of emergencies could not promote thrift and self-reliance in the individual.

Their example is a far cry from the situation which prompted the recent publication in *Time Magazine* of an advertisement entitled "You'd Think Americans Still Believed in Santa Claus," and which reads in part as follows:

"To read most of the post-war plans for a better world, you'd think they

were written by Santa Claus for little children. This war is being fought for freedom from political oppression, not for freedom from work. It's time someone had the courage to tell this fundamental truth to Americans and the whole world:—as long as you have your health nobody is ever going to give you anything; you are never going to *have* anything you don't earn by hard, efficient work.

"The only time the laws of economics can be suspended is during a war . . . it's easy now for anyone to get and hold a job whether or not he does it efficiently and earns his pay. That time is almost over, and no power on earth can prevent its ending. When the war peak has passed, the only man or woman who will hold a job and prosper and progress (whether the job is management, shop, office or—we hope—political) will be the one who understands that he can only be paid out of what he produces, and so will produce better in order to get better pay."

Through all the first century and a half of American life there were recurring periods of prosperity and depression, or speculation, inflation, panic and debt repudiation. Each era was marked with its own variation of age-old problems—each generation struggled with those problems and eventually arrived at its own answers in its own way, with the result that the nation emerged from each depression to new higher levels of national well being.

The ideals of individuals have changed but little during this period of American life. In the final analysis it is the objective of all people to (1) secure sufficient income to meet the current standard of living, whatever it may be, (2) to meet their proportionate share of the cost of necessary government, (3) to protect themselves and their families from emergency and catastrophe through adequate insurance, and (4) to accumulate wealth. Through all the cycles of economic change, these predominant principles did not change materially, even though individuals sought within the framework of American traditions the fulfillment of those desires by devious ways.

The problems of the individual in the aggregate constitute the problems of the communities, states and ultimately the nation. Thus, as we have expanded production and the resulting exchange of goods and services, we have expanded our national income to provide for a constantly growing population and a constantly increasing standard of living for all. Our problem becomes acute when the laws of economics are thrown entirely out of balance by abnormal conditions such as those of war.

An analysis of the period immediately preceding and during the first World War indicates that we stepped up our production facilities sharply to meet the emergencies of war production, and the result of this abnormal production and the resulting exchange of goods and services developed a national income far in excess of what we had been able to sustain in the pre-war period. The problems arising out of the war were not recognized in time to avert the tragedy of the post-war period, and because we failed to find a satisfactory program to take the place of war production, we experienced the depression of the 30's. The alternatives were to reduce our standard of living to a basis which would be supported by the then available national income; to find a program of peace production to take the place of war production; or to resort to government to hold us up by our boot-straps, hoping against hope that some miracle would bring us out of this dilemma. Because agriculturists, industrialists, business and professional men failed to solve the problems which arose, these problems naturally drifted to the doorstep of government, and for a decade we abandoned the fundamental principles on which the country was founded and gambled with a dangerous new principle of government subsidy. We were soft from post-war prosperity and we had forgotten the economic lessons handed down by the pioneers. We permitted our government to exceed the bounds of emergency relief until people finally began to say there was a responsibility on the part of the government to sustain us in our standard of living. Politicians seized upon this opportunity and began promising citizens more and more government bounty. Finding their promises popular, the snowball of a permanent dole began rolling down the hill, gathering size as it gained momentum.

We were still in the throes of this new philosophy when the second World War began in Europe. Twenty years after the close of the first World War we had not developed a normal national income to equal the national income brought about during the first World War and to which, unfortunately, we allowed our economics to become adjusted.

If we had not previously been aware of our weakness and our trend we should have become suddenly awakened at the example of conquered France, once proud, self-reliant and strong, but sapped of its life blood by the same virus that infected us. We had witnessed the nonchalance and confusion of a peace-time France where the thirty hour week was in vogue and where leaders and people alike had forgotten that liberty cannot be purchased or guaranteed by indolence. Only the waters of the Atlantic and our distance from the mad dictators of Europe and Asia saved us from the fate of France, for the pattern we have followed in these United States is a similar pattern to that followed by the people of France.

Then came the tragedy of Pearl Harbor, a body blow at the time, but it was the first real stimulus forcing us to unite and make amends for the years of sleep walking. It rocked us from our nonchalance, and brought us to the keen realization that no country can meet the problems of either peace or war except in a manner embodying those same pioneer principles which have been inherent in our people since the founding of this country.

Conferences recently held by the leaders of the United Nations symbolized unity of purpose to destroy the military might of the Axis powers to such an extent that no nation will ever again dare to embark on a program of conquest by military force. Americans everywhere are united on this objective, but they are deeply concerned about the promises and commitments being made which will carry over into the post-war era within Axis-conquered countries. Here again may be applied the history of American democracy and the matters of charity and relief. If we exceed the strict limits of emergency relief to a war torn country, we are sowing the seeds of a world-wide breakdown, the same problem which we confronted in our own country. Surely the parallel is clear and we will never promote thrift, self-reliance and self-sufficiency in any country if we go beyond the relieving of emergencies.

With the tremendous spread in the standards of living and the desires of people throughout the world it is ridiculous for us to attempt to lift them over the span of development which only years of evolution can accomplish. We

should let the world know that Americans are in this war to destroy military might and that we will maintain hereafter a position which will enable us to meet such an emergency if it ever arises again. Beyond this it is our desire that each country adopt its own form of government although we offer as Exhibit "A" our American system as a pattern, which for over three centuries has functioned in both times of peace and times of war. Our country has always been known as "The Land of Opportunity," a place where honesty, initiative and toil reap high rewards. Among them are the satisfaction of rendering a public service with the possibility of gain, ever mindful of the hazards of loss and the privilege of the several freedoms enjoyed only under our form of government. Our evidence is that under this system we have built the greatest nation on earth, where we have the highest standard of living, enjoy more luxuries and recreation, and have a higher wealth per capita than any other people on earth.

This did not merely happen—instead it was the result of adopting sound principles and philosophies, and careful planning on the part of our people.

For more than two years we have witnessed the tremendous effect of production dollars and the resulting exchange of goods and services. Although war production is an unsound foundation for national income, it definitely proves the contention that production dollars, regardless of source, do provide the basic element of national income. The danger during such a period as we are now experiencing is, that this abnormal production results in the establishment of a national income which cannot be sustained in peace time. Except as we find a program to take the place of war production we shall of necessity be confronted with the same problems which confronted us in the late twenties.

Thus we find the keynote of necessary action and leadership on the part of business, labor and agriculture. There are numerous committees making plans for the post-war period, but it is doubtful if we can develop such a peace time program except as we get down into every community and find new opportunities for production, the expansion of business institutions and the resulting exchange of goods and services.

In the past we have lacked appreciation sometimes that definite basic industries are proportionately important in our scheme of things and that each of us must become interested in the development of industry and business other than our own, to the end that we may all advance together. To maintain our national economy we must have industry and production; there must be stores, doctors, garages, power companies, mills, processors, wholesalers, etc., for in this aggregate rests the welfare of the nation and all of its people.

Our success in meeting the war production schedule is attributed to the fact that capital and labor united their forces and progress never before believed to be possible was achieved. When we unleashed our tremendous productive capacity, out rolled the implements of war in staggering quantities. A similar contribution has been made by agriculture. Only when there was a breakdown of unity did we experience the retarding of the progress in war production.

During the history of the American nation, as industry and business expanded from its humble beginning, it was necessary that government expand to make the rules for the game of production, the exchange of goods and services, and to function as an "Umpire" of this great American game. It is un-American for any one to resist this fundamental principle and, equally important, it is un-American for government to exceed its capacity as an umpire. It seems likely, at this time, that public insistence will eventually bring about a reaffirmation of government's historic role and an elimination of bureaucracy's present tendencies.

The Preamble of our Constitution states twin objectives: That in "times of peace" we will use our resources and manpower to promote the general welfare of all the people and in "times of war" we will utilize these same elements for the common defense of the nation and its people. The founders of our country believed a system of government could be established which would be flexible enough to accomplish these two objectives. In recent months we have seen the successful shift to war production to the end that we have provided for the common defense of our country and its people. Today we as citizens must accept the responsibility of determining the methods and guiding the course of shifting back to peace time production, so that we may again embark upon the objective of promoting the general welfare, which means, in simple language, to provide employment for all of our people, to maintain our standard of living, to meet the cost of government, including the orderly liquidation of our indebtedness, and to provide more of the good things of life for all the people.

To develop American production and its resulting exchange of goods and services sufficiently to attain the desired national income, it will be necessary to achieve a better understanding between the various groups within our economy which too often are in conflict, namely, capital and labor, agriculture and industry, and government and business.

Equity must be established between those employed in production, those who venture the capital and those who purchase the products, whether industrial or agricultural.

We have witnessed the tremendous increase in wages in war production centers and unfortunately too many individuals will have become adjusted to a standard of wage which cannot be sustained in our peace time pursuits. If we are to win the peace we must assume leadership in the battle against mass unemployment, to the end that we may provide jobs for all, with pay checks adequate to meet the cost of living, the cost of government including the orderly liquidation of our tremendous indebtedness, and savings for the thrifty. Within the wage structure as finally adopted an incentive system must be created and preserved, for incentive is the greatest stimulus to production, as proven by our past history. Capital, too, must have the incentive and opportunity for a fair return and be permitted to build reserves against periods of depression and for the ultimate renewal and replacement of its physical properties.

When we have concluded the military conflict we will have national, state and local indebtedness approximating three hundred billion dollars. In the final analysis the indebtedness of a nation or its political subdivisions is comparable to that of an individual. It must be liquidated by earnings, or failing in that capacity, we face the foreclosing of the mortgage, which means for a nation the conscription of wealth. Surely we cannot look to government to provide jobs and projects to develop national income. Our efforts must be directed towards the establishment of a program for expansion of private industry and business, which in addition to providing profitable employment can carry its share of the tax burden. We should determine a program of necessary public works for

the construction of those things which we need and can afford. This program should be used to cushion the periods of readjustment with which we are periodically confronted.

We as individuals, almost without exception, have the same objectives in life. In accomplishing the objectives, we reserve the right to operate individually, or associate together as partners, corporations, or any other form of association. But when the tax laws give a preference to any one group, it must be expected that the transition will be in that direction.

Thus if we are to face the liquidation of indebtedness without conscription of wealth, those who draft our tax laws must pattern them so that the burden will be equally distributed. To do otherwise will eventually crush those individuals or institutions carrying more than their proportionate share, and thus we may find too late that conscription of wealth is the only manner in which our obligations can be met.

In the final analysis, if we can analyze and settle some of these economic questions then we will be ready to embark on a program of transition back to peacetime production. If they are not settled equitably and soundly, we can expect the conflict and confusion which has been so prevalent in the last decade and which ultimately will break us from within.

If we as a people can establish equity between capital and labor, a proper climate for agricultural production and marketing, and achieve a renewal of government's historic role as an umpire, we can establish a peace-time production which will enable us to maintain our standard of living, pay our proportionate share of the cost of government, including the orderly liquidation of indebtedness and continue to accumulate wealth.

On these objectives, business, labor and agriculture should be firmly united, and their cooperation will continue to be profitable in free enterprise bearing the standard "Made in America."

EEI Commercial Planning Committee Releases First of Series of Postwar Planning Reports

A CAREFULLY prepared forecast as to post-war conditions in the electric power industry with respect to generating capacity and sales of electricity is contained in the first of a series of Postwar Planning Reports by the Commercial Planning Committee of the Institute, released to EEI members in September. Merrill E. Skinner, vice-president of the Buffalo Niagara and Eastern Power Company, is chairman of the committee. Other reports in the series now under preparation and to be released at intervals this fall cover the following subjects:

An Appraisal of Our Competition
A Summary of Available Data on Residence Load Characteristics
Probable Changes in Power Use of Major Industries
Rural Electrification
Market Problems in the Residential Field
Postwar Lighting Markets

These conclusions are reached in the first report, Basic Planning Material for Electric Utilities:

> The postwar outlook for the business-managed electric utility companies as a whole in this country, is that during the period of readjustment there will be no great amount of idle plant capacity, hence no cause for distress selling. There should be enough capacity available to warrant and stimulate renewed effort to sell more electricity, to find new fields of usefulness and to exploit further possibilities in the older fields. The competition again will be for a share of the consumer's dollar. It will be competition of the keenest type but electric utility companies, confident of the value of the service they offer, expect to load up the relatively small margin of unused capacity in a few years after the war is over.
>
> The fact that new generating equipment is now being ordered by some companies is the best possible indication to support the validity of this forecast.
>
> Sales of electricity to domestic consumers by 1950 are estimated to reach a figure approximately 50 per cent greater on a country-wide average than in the peak year of 1943, although estimates for sales by individual companies vary from a minimum increase of 25 per cent to a maximum of 100 per cent in the seven-year span.
>
> Industrial power sales for the immediate post-war years are expected to return to the level of 1939, and subsequently increase with full scale resumption of normal civilian production.
>
> Total kilowatthours sales in all classifications, however, at the lowest point, anticipated to occur three to four years after the European war, are expected to hold at about 35 per cent above the level when the European war broke out.
>
> For the electric utility companies as a whole, there will be gradual rather than sudden shift from business dominated by war expenditures to a civilian economy, the report says. "It is now clear," it adds, "that as soon as materials and manpower are available the companies and the electrical equipment manufacturers will resume efforts to enlarge the residential, farm and retail commercial uses of electricity. A lag may be anticipated between the period when sales promotion is undertaken and the time when its full effect in increasing sales becomes obvious, but in three or four years after the war results should be manifest in sharply rising use of electricity by all the classes of customers mentioned."
>
> "In the industrial power field it is expected that after an interval of two to four years a period of marked expansion in power sales in the Nation will be resumed. New developments in materials, machines and particularly in production methods have continued to make their appearance throughout the war period. Following the end of the war it may be expected to take a few years to bring into full play the application of these developments to peacetime."
>
> Despite heavy war demands on the industry for electricity, which in every instance have been met, no abnormal installations of generating capacity have been necessary. From 1937 to the end of 1944, the report states, the business-managed companies will have made a net increase of installed capacity of approximately 7,500,000 kw. Over the seven-

(*Continued on page* 336)

Power for Peace for Farm and Home

By C. M. Ripley

General Electric Company, Schenectady

STEINMETZ advised young engineers to "do what no one else does."

Editors advise authors to "write what no one else writes."

So in this article I am going to try to follow both these pieces of sage advice.

The Chinaman said: "The Americans do some queer things: They boil the tea to make it *hot*. And then—
They put ice in it to make it *cold*. And then—
They put sugar in it to make it *sweet*. And then—
They put lemon in it to make it *sour*. And then—
They say here's to *you*. And then—
They drink it *themselves!*"

And electricity does some queer things too—notably when it handles liquids:

It makes water flow uphill to the house. And then—

It turns cold water into hot water. And then—

It turns warm water into ice. And then—

It makes more water flow uphill to the pigs, chickens and milk cows. And then—

It pumps the milk downhill into the milk cans. And then—

It separates the cream from the milk. And then—

It churns the cream to make butter. And then—

It refrigerates the butter to keep it. And then—

It cools the buttermilk to keep it. And then—

It warms the milk to pasteurize it. And then—

It cools the milk to keep it. And—

It does all these ten things while your back is turned!

There are about a half million electric milkers on our farms; and they milk perhaps one-third of the yearly output of 5,000 million gallons.

Surely when it comes to liquids, electricity *is* versatile.

Versatility

But this quality of electricity is not limited to liquids.

A windmill can pump water, but it can *not* toast bread. Electricity does both.

A horse can pull a load, but it can *not* run an x-ray up at the hospital. Electricity does both.

You can refrigerate with ice, but ice will *not* provide ultra violet rays for developing baby chicks and pigs. Electricity does both.

You can cook with several different kinds of fuel, but not one of them will run your radio.

So you see, electricity is jack of all trades and master of ALL. War jobs made women realize that electricity improves their working condition, for it's the easiest, nicest, fastest, cheapest way of getting light and power and heat, and the *only* way to get radio and other electronics.

And electricity is cool and nice—for it makes flameless light, and flameless power and flameless heat.

No soot floats in the air after you light an electric lamp, or after you turn it off.

An electric motor has no exhaust pipe vomiting out poison carbon monoxide fumes.

Electric heat uses no air and creates no products of combustion to pollute the atmosphere.

Water Systems

But the manpower and womanpower saved by milkers, as important as it is, is dwarfed by comparison with the electric water systems. Nearly one million electric water systems supply our farms with 20,000 million gallons of water every month! The water pumped (generally up) is about 50 times as great in volume as the milk (which is pumped down).

The 20,000 million gallons of water every month equals 1/12 of all the water which is used in the United States power plants in Niagara Falls.

I heard Harry Miller of the Gould Pump Company give a talk sometime ago. In it he said:

1. One year the farm women in Bucks County, Pa., walked a total of 27,000 miles, carrying water pails to and from their pumps.

2. He said each woman carried from 25 to 50 tons of water a year, and while doing that had to walk further than around the world!

3. He said you can pump 1000 gallons for 10c and often less. 1000 gallons weighs four tons. Think of it—four tons of water for a dime!
Labor, bother, sweat and time,
Would *you* pump four tons for a dime?

And he showed the versatility of the electric pump because it will pump from a well, a cistern, or spring, or river, or from a lake.

It's too bad that on all the farms except about a million, women still have to pump and carry water to the stove, to the tubs, to the sink and to the numerous pitchers and pots, and the men still have to pump and carry water for the horses, cattle, hogs and chickens. But in a fire—that is when a water system really proves itself a priceless possession!

I also heard Mr. John C. Myers, President of the Myers Company, tell how hard most housewives have to work:

1. The surface of the dishes which she washes every year, is measured in acres!

2. The length of the year's clothesline is actually measured in miles!

3. The faces and hands of the children must be washed many times daily.

4. Water is needed for 100 necessary chores every day, needed by the pailful; and on blue Monday, washday, it is needed by the tubful.

Those relatively few farms that do have a water system, do not have to pump water. And

They do not have to carry water *into* the house.

When they have a sink, they do not have to carry water *out* of the house.

Those who have a hot water system, do not have to carry hot water to and from the stove, to the washtubs, to the bathtub, to the sink or to the sick room upstairs.

The washing machine does away with the dreaded drudgery of the scrub-board. It has the strength of 13 tireless women and it costs about a dollar a year for electricity to run it.

In ironing, electricity *heats* the hand iron, but does not *move* it. But in an electric ironing machine electricity fur-

nishes the heat, and the pressure and the power.

Besides, you can sit down while using an ironing machine. The cost of electricity is practically the same, whether you stand up above a hot iron, push it back and forth and get overheated, and continue this torture for six hours; or whether you sit down, not *over*, but *away* from the heat, keep cool, take it easy and finish up in 3 or 4 hours. The speed of the ironing machine is such that the monthly bill is practically the same as for a hand iron.

The electric refrigerator costs about a dollar a month to run.

The electric clock uses only 2 watts, which is not enough to start the electric meter.

The electric range uses flameless heat; and with an exhaust fan above it, the combination makes the kitchen a cool, clean, safe, sweet smelling place where work is almost play.

And then, don't forget the safety of outdoor floodlighting, and those little all-night lights that help you find your way around, and also discourage prowlers.

Women will create a big demand for refrigeration after the war, because they are the guardians of the family's health.

Thousands of people drive every day to their war jobs in Schenectady, from farms and towns and villages as far away as 30, 40 and more miles. What is true of Schenectady is probably true of others, so what women have learned in the factories, is not limited by any means to *city* women.

Housewives and farm wives too have been made "powerwise" by their war jobs. They have learned by actual experience, the value of electric power and the ease with which jobs can be done without exerting any physical strength.

And all housewives, farm wives or not, quickly sensed that there is no investment which pays better dividends than electrical appliances—the tools which allow electricity to work for them at home. They know that when they buy electricity they buy work—muscle work. And I think the *greatest* field for electricity in the future is in providing power for actual human living.

Steinmetz on Post-War

A few days after the Armistice in 1918, I asked Dr. Charles P. Steinmetz: "Now what's going to happen?"

He answered "Watch the Allies quarrel among themselves, but we are going to have a big boom." I asked him why and he said, "Because store shelves are nearly empty, many people have wanted many things for a long time, and lots of factory, farm and home machinery is either worn out, or obsolete, or both."

And a big boom we did have too. In the next eleven years, about a million wired homes were added each year. It was then that the electric refrigerator was introduced; and the radio; and the electric clock. All those *recent* developments were sold at an unbelievable rate. Incidentally, their sales continued right through the depression, and only freezing stopped them.

There are more refrigerators in use now than there are toasters.

There are more clocks than there are washers.

There are more radios than any other appliance.

Strange, isn't it, that the *older* products like toasters, washers, percolators and chafing dishes, all of which are relatively cheap, have been outstripped by the newer and more expensive radio and refrigerator.

War Jobs Made Women Powerwise

Women now have seen that men in their factory and office jobs, have had electricity to do the muscle work for them for many years back. Whereas from break of day to setting sun, woman's work was never done.

They now realize that waitresses, hotel chamber maids and laundresses, yes, and millions of housewives too—used to do more hard physical work at their old jobs than they now have to do in the war plants.

Housekeeping America's Greatest Industry

We hear a lot about the *big* steel industry, the tremendous railroad industry, etc. But more people are engaged in housekeeping than in *any* other industry.

More money is invested in housekeeping than in *any* other industry.

More money is spent annually in housekeeping than is spent or earned by *any* other industry. Housewives spend 30 billion dollars yearly—or more. This is more than the total revenue of the steel industry, plus that of the textile industry, plus that of the railroads. This is because *living* is the *be-all* and the *end-all* of *all* industry!

In the 36½ million homes and farms in this country, more work is done by women than is done by all the hod carriers and all the iron and steel workers in the country.

But the 4 or 5 million women and girls now at work in war plants, know how electric power shifts the muscle work from their shoulders, where it was a burden, to the power house, where it belongs.

4800 Watts per Worker

What they are experiencing is the result of America's greatest progress in industrial economics. They may not appreciate that there are 6½ hp of motors installed for each average industrial worker in American factories. This is 4800 watts. It is probably 140 times the power of a strong man for eight hours; and about 280 times the power that a woman or girl can exert for eight hours. So *her* production is multiplied at least 280-fold, compared with what she could produce with her own muscles.

They appreciate that they in the factories don't have to lift heavy loads or throw ponderous levers, or pull on steel chains or wind up winches, or do any other heavy work. No indeed! They *sit* there, and *push buttons*, and step on pedals, and throw switches.

Their nimble fingers and bright eyes furnish the skill, and electricity does the *muscle work*. Women and girls surpass men in many jobs, because with their smaller hands and their dexterity, they can work better and quicker at many jobs than men, whose fingers are all thumbs.

When soldering irons, or electric screwdrivers or riveters weigh more than a couple pounds, they are often hung from the ceiling, so the woman does *not* have to *support their weight*, but merely *direct* the tool. Owen Young said over 20 years ago, "Factory workers are becoming directors of power and not generators of power."

Worst Engineered Industry

But whereas American *industry* has been very thoroughly electrified the biggest industry of all—housekeeping—is still quite backward — very poorly equipped for using electric power.

I predict that women factory workers, who return to their homes, will set up a huge demand for electrical appliances of all kinds. The timid ones have learned not to be afraid of electricity, gears and machinery. Their factory jobs showed them how safe it is to use electricity.

Moreover, they have learned a lot about ventilation, and how motion study helps to conserve energy. The women demanded about 20 million refrigerators

in 15 years *before* the war, but that will be small compared with what they will demand *after* the war. And what's more, they have their own money, and their husbands' money, and can pay cash down on the barrel-head.

Whether the old-fashioned hired girl will vanish or not is a question. Millions of girls and women who have had a taste of $40 a week or more, will not want to work at the old wages of $6 to $10 a week.

Perhaps after the war, even the upper middle class homes cannot afford to pay a maid the wages she will demand.

Right now, newspaper want ads are offering $25 to $35 a week for maids. I read one ad of nearly 100 words, offering the maid her own room and private bath, and further enticing her with a list of electrical appliances that she would have to help her do the work. It included a dishwasher, complete electric kitchen, and other most modern devices.

Then there are about 1¼ million marriages every year. Probably most of the brides have been working, and they feel modern and independent. With war bonds, and cash, they could even buy some of the appliances with their own money, and shame their fond hubbies into buying the rest. Why should they work harder at home than they did in the factory, and not get a big fat pay envelope?

More Empty Shelves Than After World War I

This war already has lasted longer than World War I. And more *things* have been frozen than in World War I. More shelves are empty, and yet there are more people in America.

The flood of orders after peace is declared will be like the bursting of a dam. When appliances are thawed out after several years, the boom should eclipse the Coolidge boom.

Then on top of that is the replacement market. The deferred repair work will swell the tide.

Advertising Also Will Help

I heard a pessimistic sales manager say once that "Three days of hot weather in succession, will sell more fans than $10,000 worth of advertising."

But think what five or six years of frozen appliances has done to dam up sales. The "Three days of hot weather" is not a drop in the hogshead—compared with the orders we are going to get after peace is declared. And obviously, each year that the war continues, the greater will be the demand when it finally comes!

These power-wise housewives will be more likely to believe us when we prove in advertising that "It cost less to live better."

We must explain how it is that the more electricity she uses, the cheaper it gets.

We must show her that in most communities she can buy $24 worth of electricity every month for $10—America's greatest bargain.

She must realize that in the past she has only been spending about a dollar a week for electricity, and, therefore, she uses electricity only as a part-time service. But that for just one dollar a week more she could use it as a full-time service and drive out all the dreaded drudgery of old-time housekeeping.

To wash dishes by hand is as obsolete as to run a grinding wheel with a foot-pedal. In order to get the low electric rate she must have an electric range, and she will never part with it after the first week—especially if it is hot weather.

We must tell her that she needs the modern tools at home, just as they were needed in the factory; and that if she doesn't demand them, and get them, she must *pay* for them in the wastefulness of the old obsolete equipment and the time she spends, and in the health and beauty which she loses by putting up with the same housekeeping utensils methods used by her mother and even her grandmother!

Whatever we need in this world we must pay for, whether we buy it or not. We must tell her that she will *stay younger longer* in the all-electric home. She learned in the factory that electrical machinery shifts the muscle work from her shoulders, where it was a burden, to the power house where it belongs. We must explain to her that when she uses electricity on a full-time basis she gets a low electric rate—one that practically amounts to a wholesale rate.

We must tell her again and again that one cent's worth of electricity—practically the cost of one cigarette will:—

Toast 10 slices of bread.

Medium-boil 10 eggs in steam.

Percolate the breakfast coffee.

Run an all-night bulb for four nights.

Run a kitchen fan for four hours or more.

Run a food-mixer for about an hour, keep the refrigerator in service from three to five hours.

We must remind her that the cigarette lasts four minutes, but electricity lasts an hour when she runs her largest vacuum sweeper. When we promote all-electric homes, and all-electric kitchens, we sell electric appliances in bunches, like grapes.

We should turn appliances into real estate, and put them in the mortgage.

For 10 years I have been speaking and writing that the all-electric kitchen was the white hope of the electrical industry, and the all-electric home the dark horse. I predicted a vast increase in the domestic load. The rural, plus residential, consumption, last year was almost three times that of the boom year of 1929!

Did What No One Else Did

When the manufacturers were selling refrigerators, I had an all-electric kitchen.

When they got to promoting all-electric kitchens, I had an all-electric home.

When they got to promoting all-electric homes, I had about 10 years' operating record, with separate meter readings, thousands of them over a period of seven years.

I found that one-third of my kilowatt hours were used for appliances that used electric heat; one-third for those that used power, and one-third for lighting and miscellaneous minor appliances that could not well be separately metered, as for instance, the vacuum cleaners.

Surely we can sell appliances in bunches like grapes: And what kaleidoscopic changes and super duper saturation we are going to get—if we plan now.

Women have probably learned how small their power is now compared with machinery. The 21-watt power which a woman can exert all day means that she must work long hours. But the big power of electricity means a quick job and short hours.

We can remind her that she didn't see any old-fashioned machinery in the factory—that was all junk years ago. And just so *she* should junk the housekeeping methods of the Gay Nineties and abolish the chores women have done for generations, with equipment as modern as that which she used in the factory.

Yes, the housewives at war work have become power-wise and *if we are ready, we can win her business, and her good will—yes—even her enthusiasm.*

It is almost axiomatic, that the most satisfied customers are the ones that get the low rates; and the ones that get the low rate are those that have an electric range, an all-electric kitchen or home.

Properties of Electrical Insulating Compounds Made from Buna S (GRS)

A Progress Report

By E. W. Davis

Chief Electrical Engineer, Simplex Wire & Cable Co.

Presented at a Meeting of the Transmission & Distribution Committee, E.E.I., Chicago, May 2, 1944.

SEVERAL papers and reports on the properties of electrical insulating compounds made with various synthetic materials in place of natural rubber have appeared in the technical press or have been presented before technical societies and committees during the past few months. Most of them have been necessarily of a general nature, without substantiating data. A wide range of both thermoplastic and thermosetting materials has been considered.

This paper will discuss the properties of electrical insulating compounds made from one of these materials, namely, standard Buna S (GRS). The data given are for compounds subjected to a single cure only and are from the laboratories and factory of the Simplex Wire & Cable Co. No attempt has been made to get correlating data from other laboratories or manufacturers, nor is any claim made that the opinions expressed represent other than those of the technical staff of that one manufacturer.

Of all the materials commonly used as insulation on elecric wires and cables, rubber compounds undoubtedly have proved to be the most versatile and useful. With them we have obtained low dielectric constant and lower power factor for communication circuits, high dielectric strength and ozone resistance for power circuits, low water absorption and stability for submarine cables, long life and heat resistance for cables operating at high temperatures, and flexibility at both high and low temperatures.

Already Buna S has proved remarkably successful in duplicating the versatility of natural rubber as the basic ingredient of insulating compounds. Buna S and natural rubber differ in many ways and the manufacturer must give particular attention to those properties which contribute most to the usefulness and probable life of an insulating compound in service.

The following characteristics of an insulating compound are of prime importance.

1. Deterioration due to oxidation or heat.
2. Electrical characteristics—
   a. Dielectric strength
   b. Dielectric constant
   c. Power factor
3. Ozone resistance
4. Water absorption

Other characteristics, such as initial physical properties, insulation resistance, etc., are also important, but the fact that tensile strengths, insulation resistance values, and perhaps some other properties of Buna S compounds tend to be lower than common values for natural rubber compounds does not mean that the new compounds will not be as serviceable.

In appraising the physical properties of Buna S insulating compounds it is customary to rely upon physical and aging tests which have been found, through extensive laboratory work and years of service, to be useful in predicting the probable life of compounds made with natural rubber. The commonest accelerated aging tests are known as Geer oven, oxygen bomb, and the air bomb test. In most test procedures, the decrease in tensile strength and elongation after a definite period of exposure to the test conditions has been accepted as a measure of the probable life of an insulating compound which in service will be subjected to ordinary dry exposure.

The effect on the tensile strength of most natural rubber compounds when

TABLE I

Initial Physical Properties - Buna S Insulating Compounds

A.S.T.M. Performance and Heat Resisting Grades

(Single Cure Only)

Grade	Number of Samples Tested	Percent Passing Tensile Pound per sq. inch			
		700	800	900	1000
Heat Resisting	272	100	96	80	43
Performance	161	100	96	90	81

Grade	Number of Samples Tested	Percent Passing Elongation, Two inches to					
		7	8	9	10	11	12
Heat Resisting	272	100	94	90	85	84	77
Performance	161	100	100	99	92	89	67

TABLE II

Properties after Aging Tests - Buna S Insulating Compounds

A.S.T.M. Performance and Heat Resisting Grades

(Single Cure Only)

Grade	Number of Samples Tested	Percent Passing							
		96-Hr. O. B. - 70°C.				8-Day O.B.-80°C.		20-Hr. Air Bomb	
		Not over 25% Depreciation		Not over 35% Depreciation		Not over 50% Depreciation		Not over 50% Depreciation	
		Tens.	Elong.	Tens.	Elong.	Tens.	Elong.	Tens.	Elong.
Heat Resisting	272	100	100	100	100	100	100	100	100
Performance	161	100	55	100	82				

exposed to the test conditions in any of the life tests is greater than the effect on the elongation. In fact, in the most severe test—the air bomb—the tendency is towards a softening of the compound under test, with a marked decrease in tensile strength, but often little effect on the elongation. Buna S compounds tend to become brittle with a marked decrease in elongation but often an increase in tensile strength. Hence, it is necessary to revise our conception of a long-life compound. High tensile strength in a Buna S insulating compound may not mean so much as in the case of a natural rubber compound. A Buna S insulating compound with 700 lb initial tensile strength and 10-inch elongation may be more desirable than one with 1000 lb tensile strength and 8-inch elongation.

The manufacturer is confronted with new problems as he tries to formulate Buna S insulating compounds with the best balance of all properties.

One of these is the more delicate adjustment of compounding ingredients which seems to be required with Buna S when different processes are used to vulcanize the insulation, i.e., continuous vulcanization or pan cure. Great progress has been made along the lines of such adjustments so that today Buna S insulation can be produced by either process with assurance of adequate electrical and physical properties to meet almost any service condition.

Another is the great dependence of the tensile strength of Buna S compounds upon the surface condition of the test specimen. Surfaces which are free from defects will produce uniform tensiles, whereas a surface that is not free from defects will produce tensiles that are low and not uniform. This point is brought out strikingly in a most interesting contribution to the subject which has been published as General Report No. 9 of WPB—"The Tensile Strength of GRS" by J. L. Bearden, the B. F. Goodrich Co., dated Feb.15, 1944. One conclusion from this paper is that in natural rubber compounds the tearing is so rapid under high stress that no prophesy concerning where the break will actually occur can be made. However, except for the smoothest of cured Buna S (GRS) samples cracks will occur during tensile test, sometimes few and sometimes many, 2 or 3 in. below the ultimate elongation. In these cracks the compounds tear rapidly near the breaking point and prediction can be made as to the point of break. For practical purposes this re-emphasizes the exceeding importance of very careful preparation of test samples.

Still another of these problems is the factory processing which has to be varied somewhat from the techniques usual with natural rubber compounds, and the associated question of the control of variations.

Table I and II show test results on a large number of samples taken from "factory runs" of Buna S insulating compounds. The spread of the values results from the inclusion of the tests

TABLE III

Grade	Short-Time Diel. Strength at 60 Cycles - V/M Thickness	
	Buna S	Natural Rubber
Code	360 - 400	375 - 425
Ozone Resisting	350 - 450	400 - 500
30% Performance	400 - 550	450 - 550
Heat Resistant	400 - 550	450 - 550
Low Water Absorption, low S.I.C.	550 - 650	600 - 700

TABLE IV

Dielectric Constant of Buna S and Natural Rubber Compounds

Grade	Buna S	Natural Rubber
Code	4.50 - 6.00	4.50 - 6.00
Ozone Resisting	4.00 - 5.00	4.25 - 4.75
30% Performance & Heat Resistant	5.00 - 6.00	5.00 - 6.00
Low Water Absorption, low S.I.C.	2.85 - 3.20	2.75 - 3.00
Low Power Factor Types	2.85 - 3.20	2.75 - 3.00

TABLE V

Power Factor Percentage
Buna S and Natural Rubber Compounds
1000 Cycles

Grade	Buna S	Natural Rubber
Code	4.0 - 7.7	5.0 - 7.0
Ozone Resisting	2.5 - 3.6	3.0 - 3.5
30% Performance & Heat Resistant	2.3 - 7.0	4.0 - 6.0
Low Water Absorption, low S.I.C.	.8 - 1.5	.8 - 1.3
Low Power Factor Types	.8 - 1.5	.8 - 1.3

TABLE VI

Ozone Cutting Tests
Vertical U Samples - Bent 5 x O.D.
Stressed 100 V/M - 60 Cycles

Minutes Rest	Sample No. 1 Minutes to Failure	Sample No. 2 Minutes to Failure
.5	12	10
5.0	15	27
60.0	No failure - Tests discontinued after 20 hours	

TABLE VII

Mechanical Water Absorption
Buna S and Natural Rubber Compounds
Gms. per sq. in. of surface after 7 days
at 70°C. in distilled water

Grade	Buna S	Natural Rubber
Code	30 - 45	35 - 40
30% Performance or Heat Resistant	25 - 40	25 - 35
Low Water Absorption (Coast Guard)	9 - 22	10 - 20

TABLE VIII

Electrical Water Absorption
Buna S and Natural Rubber Compounds
Coast Guard Type
Increase in 1000 Cycle Capacitance in Water at 70°C.

Days in Water	Buna S	Natural Rubber
1	0	0
8	2.6 - 6.0	1.5 - 5.0
29	6.5 - 12.0	3.5 - 12.0

for several formulas within each of the two grades of compounds shown, different sizes of wire, different methods of cure, etc.

Electrical Properties

The electrical characteristics of Buna S compounds are of prime importance. Test values very similar to those for corresponding natural rubber compounds can be realized.

Table III shows range of dielectric strength (short-time test) on common grades of Buna S insulating compounds and the comparable natural rubber compounds.

Dielectric constant (S.I.C.) is important for communication cables and for its contribution to loss factor in high voltage cables. It also is of importance in cable design where ozone and corona can be controlled. Table IV indicates ranges for Buna S and for natural rubber insulating compounds.

A rather wide range given in each case in the above figures is due to slight variations in compounding formula within each grade, different test conditions, etc. Primarily, the table substantiates the statement that values for Buna S compounds are very similar to those for comparable natural rubber compounds.

Power factor, like dielectric constant, is important in communication circuits and also because of its contribution to loss factor in power cables for high voltage. Table V indicates data on this property.

Ozone Resistance

Ozone resistance can be obtained with Buna S compounds the same as with natural rubber. Dielectric strength of the ozone resistant compound tends to be lower than for the natural rubber counterpart. Ozone resistance is as good but our experience indicates that longer relaxation time is necessary after bending. Table VI gives typical test results on a Buna S compound of this type.

Water Absorption

A most important property, for some cable installations, is water absorption, since moisture may seriously interfere with cable operation. Natural rubber compounds varied greatly in this property and only those specifically compounded to have low water absorption could be relied upon in wet locations unless protected by completely impervious covering. With Buna S compounds comparable results have been obtained. Table VII is offered as a general comparison of types.

TABLE IX

Grade of Compound	Rubber	Applicable Standard Specific	Under-writers' Type	Max. Cont. Operating Temp. of Condr.	Max. Recom. Operating Voltage	General Service Application
Code	Natural	N. E. C. N. E. M. A. JC 101b	R	50°C. (122°F.)	S. C. Lead-5 Kv Brd. & MC Lead - 3 Kv	Building wire (light and power circuits), Lead Cov'd Parkway Control, Service entrance, etc.
	Buna S	N. E. C.	do	do	do	do
Class AO Performance	Natural	ASTM - D27 D353 NEC	RP	60°C. (140°F.)	5 Kv	Conditions more severe than Code incl. many services in power companies, utilities, & industrials for Lead Cov. Submarine, control and bridge cable etc. Also where higher currents are desirable.
	Buna S	ASTM - D755 N. E. C.	-	do	do	do
Heat Resistant	Natural	ASTM - D469 N. E. C. JC 106a JC 121	HR	75°C. (167°F.)	5 Kv	High ambient temperatures. Where max. current carrying capacity is req'd. Where heat resistance is desired.
	Buna S	ASTM - D754 N. E. C.	do	do	do	do
ANOROC High Volt. low cap. type	Natural	Simplex	-	70°C. (158°F.)	22 Kv	General high voltage and communication purposes under impervious sheaths or dry locations.
	Buna S	Simplex	-	do	12 Kv	do
Submarine	Natural	U. S. C. G. Simplex	-	70°C. (158°F.)	22 Kv	Used in non-leaded submarine and underground cable; for services where exposed to water. Can be used for both power and communication.
	Buna S	do	-	do	12 Kv	do
Ozone	Natural	I. P. C. E. A.	-	70°C. (158°F.)	17 Kv	Used for braided leads, for apparatus, transformers, braided cable in metallic duct, braided or taped aerial cable on messenger. High tension test leads, etc.
	Buna S	-	-	do	10 Kv	do

The spread of the values is due mostly to variations in the rubber (Buna S or natural).

Together with this low mechanical water absorption there must go stability in water. Electrical water absorption tests have been developed consisting of measurements of change in electrostatic capacitance with immersion in water. Such tests are usually carried out at elevated temperatures. For specification purposes, they may run up to 29 days at 70 deg C. Table VIII shows increase in capacitance of Buna S low water absorption type of compound compared with a similar natural rubber compound, both having about 15 to 20 mgs mechanical water absorption.

Here the spread of values is due to the inclusion of data on samples with a wide range of conductor size and insulation thickness, and, of course, also to certain inevitable variations from one sample to another and from one test to another.

Available Types

Rubber insulated wires and cables cover a widely diversified field of application. In the past a number of grades best adapted by characteristics and economics to serve in their respective spheres have been in use. This practice has somewhat naturally guided us in developing Buna S compounds to replace each type of rubber compound. To a surprising degree this has been accomplished. The foregoing data establish the suitability of the new materials. But of more importance to the user is just what compounds are available for the many different operating conditions. Table IX lists natural rubber compounds, their general field of use and their Buna S alternates with their limitations.

Conclusion

The data presented herein constitute a progress report on Buna S insulating compounds now being used by one manufacturer. It shows that a great deal already has been accomplished although much remains to be done. Buna S insulations have been developed to replace special purpose, natural rubber insulations that were designed to meet specific operating conditions. Wires and cables of many types are being made with the Buna S insulations and service records are being accumulated which already indicate their value. Their life expectancy, judged from performance to date and by accelerated life tests, appears good.

Compared with our many years of familiarity with natural rubber, our acquaintance with synthetic rubbers is necessarily limited. There are yet many qualities to be developed and made available to industry and many potential fields of usefulness to be explored. Predictions as to the postwar position of synthetic rubbers is of little value today but there already is promise of a big future for these new materials.

What Women Want in Equipment for Their Kitchens of Tomorrow

A LARGE post-war demand for appliances and kitchen equipment exists among the women of America, according to the findings of a survey just made public by *McCall's Magazine* under the title, "What Women Want in Their Kitchens of Tomorrow." This survey is based on detailed reports from 11,887 readers of this national women's magazine. Women from all states and sections of the country, from large cities, suburbs, small towns and rural districts have reported to the editors of *McCall's* just what they would like in their kitchens when equipment again becomes available.

Although gas ranges strongly dominate the present cooking scene, and electric ranges run far behind, yet electric ranges are on 58 per cent of the buying lists of the women voting on the subject, with eager customers almost as numerous as those who are still undecided. The market lineup for gas ranges is only about half as great as that for electric models.

Clearly many women are not in acute need of new ranges—the tremendous interest in ranges in the period just before the war is reflected in the fact that over 59 per cent of the present equipment dates from the past six years. If women buy a new range it will be because new products have persuasive qualities. Even so, both range and refrigerator markets promise activity, but slightly higher volume seems indicated for ranges.

On the other hand it is clear that the electric range has accomplished no such wholesale conversion as the electric refrigerator; in fact, 22 per cent voice definite indifference to electric ranges.

There is no denying that women have fallen in love with electrical refrigeration. Electric refrigerators dominate the scene, and in spite of the strong coverage made in pre-war years, healthy ready markets are awaiting new electric models when they appear. Ice boxes outnumber gas refrigerators in present ownership, but in the future market, gas refrigerators fare considerably better than ice boxes. Both, however, are faced with a sizable bloc who are opposed to them. Prejudice against ice boxes suggests a highly restricted market for this product.

Most kitchens boast some kind of refrigerator; only 7 per cent indicated that they do not have one, and 80 per cent of the present refrigerators being used have been bought within the past 10 years. This might look as though there would not be many customers for replacements, but a study of the survey reveals that many women are already interested in discarding their present refrigerator for a new one.

Although more than half the voters seem in favor of a separate frozen foods cabinet, yet many would prefer more frozen food storage capacity within the refrigerator. There will unquestionably be a market for both.

The laundry is done at home in 75 per cent of the more than 11,000 households represented by women who entered the Kitchen Contest. Naturally plenty of interest in shown in types of washers, ironers, irons, and water heaters that women are going to want after the war, to speed and ease the washing-ironing ritual.

The wringer washing machine is the one most in use, but the largest demand indicated is for the automatic washing machine. The vote for this is five times as high as the figure for either spinner or wringer types.

The electric ironer received enormous acclaim. The public is not over-familiar with this product and ironers are not considered essential; nevertheless, there is a great willing market waiting, whose conversion to sales will hinge largely on the price levels of post-war ironers.

The demand in the electric iron market is relatively small. This is no surprise with a product which lies in the absolute necessity class for most households. The field for the steam iron, on the other hand, is not yet ripe, as indicated by the very high resistance vote. Confusion over what the term means is added to natural inertia to change; therefore, there must be advertising, display and demonstration before it will find many cash customers.

On the subject of electric and gas dryers, a product is again being dealt with that has made almost no penetration into average homes, and the ready market figures for both are under 10 per cent. It is not readily explained, however, why the immediate market for electric dryers is 9.5 per cent and that for gas dryers is only 1 per cent; nor why 50 per cent of the voters respond favorably to electric dryers, while interest in gas dryers goes barely over 10 per cent. One can only say that this unfamiliar product has yielded an extreme illustration of the kind of "electric fascination" that permeated the voting in several other lines. Obviously gas-appliance manufacturers must first cope with safety bugaboos and notions of up-to-dateness that sway women's minds on these matters.

In spite of the fact that gas water heaters are preeminent in the present field, women do not show much enthusiasm for them. On the contrary, if they have their way, there will be a boom market for electric water heaters after the war. About 25 per cent express lack of interest in them, but this vote has undoubtedly been influenced by operating costs and by the fact that electric water heaters have had less intensive promotion than ranges and refrigerators.

There is not much doubt that women are attracted by the electric dishwashing idea. 59.8 per cent of the contestants are watching dishwashers with a favorable eye and may be converted into customers if price and operation are right. The contest letters stressed over and over that women are tremendously anxious for a good dishwasher and there is probably no new kitchen development in which a successful mass product could achieve a more hearty welcome. Improvements will have to be made before the dishwasher can achieve volume sales, and manufacturers are already familiar with the general complaints that dishwashers do not save enough time or take care of all of the dishes; that they are rough on good dishes and not always good cleaners; that they cost more than they are worth.

Votes for electric waste disposers fall into patterns quite simliar to those for electric dishwashers. Here again it is a product about which women are not well informed, but the more knowing speak of plumbing problems with waste disposers and of limitations in the dishwasher's performance.

Good lighting ranks high among the requirements of all the voters. Many ask for special lights at work areas, and

fluorescent lighting seems to be more popular in the kitchen than elsewhere.

Kitchen ventilators get a strong hand in the report. It is called a necessary feature by 42.5 per cent of the women, and whereas the built-in types get a landslide vote, women with old houses might compromise on a portable unit because of expenses.

In the small appliances market, toasters, electric mixers and electric roasters promise fair activity. The toaster has a high present ownership coverage, but toasters have been wearing out and there are always brides. As for mixers, the market is far from saturated although more than 33 per cent of the women now have them. They stand highest, of the small appliances, in the "must have and will buy at once" classification. Electric roasters seem to be regarded as a pleasant extra appliance, not one that is essential. 15.6 per cent of the voters are not at all interested in them, and apathy from those who have already decided they do not need them brings the disinterested figure even higher. However, for the most part, electric roasters will be greeted by pleasantly disposed customers.

Enthusiasm for radios is widespread. Some women already have radios in their kitchens and 58.7 per cent are definite or prospective customers. Very few are completely against the idea of sound effects as they work.

The style poll for ranges brings to light the great success of the flat topped stove. 69 per cent of the kitchens have it and its popularity has not passed the crest. Women want their ovens to have glass doors, and they want light in the oven, as shown by an approval vote of 82.6 per cent. The wide, shallow oven is another "extra" which appeals to more than 75 per cent of the voters. This reaction ties in closely with the vote on refrigerator design—cooks like to see and get at their pies and cakes easily.

It is hard to dislodge a formula that has persisted for a long time—often only actual use of new products will accomplish the change. The close grouped planning of four top units at one side of the range remains the choice of nearly 50 per cent of the women. However, the other 50 per cent are ready for less conventional arrangements.

There was almost unanimous protest against square pots and pans from those who commented on this feature; yet when asked the question, "If square heating units gave greater efficiency, would you be willing to discard all your pots and pans to buy a range requiring special square pots designed to fit units?" almost half of the women are willing to conquer their former prejudices and accept a new development.

Range accessories are desirable but not essential to most women. The one exception is automatic heat control—here, there is practically no opposition. An automatic gas oven lighter proved to be the most controversial item.

The most numerous comments voicing complaints relate to the age and quality of the range; next in importance are the complaints on either size or design, but to offset the long and varied list of complaints is the fact that over 3,000 women listed none. On the contrary, they find them "marvelous."

Very few women wish their future color schemes limited by definite hues in equipment, hence the landslide for white ranges and refrigerators. White has become so completely identified with major equipment that it gets a check from four-fifths of the voters. Should the open-planning principle for floor arrangement which has had a high degree of acceptance in recent years, extend to include kitchens, there might be a change in this. The fact that 9 per cent of the women are anxious to have completely open layout in their new homes, means there will be some immediate market for kitchen equipment which departs radically from the white clinical type of recent years.

It is no surprise to find that few women think their refrigerators "too large"—the marvel is that nearly 59 per cent find them "just right." The trend has been toward larger and larger boxes and it is possible that when the frozen food compartment is increased in size, the six foot model will cease to be adequate.

One of the interesting victories of new design in the contest was the landslide given the wide shallow refrigerator. It triumphed almost three to one over the familiar deep one-door style. If the cost of production of such a refrigerator could be controlled, an excellent reception would await such a convenient model.

If manufacturers continue with single-door types of refrigerators, models should be available with both right and left hand openings, for according to their letters, more than 75 per cent of the women do care which way the refrigerator door swings.

An overwhelmingly high percentage of contestants are doing their own housework and preparing meals—more undoubtedly than were a few years ago, which means that some women are seeing kitchen defects which they might otherwise have overlooked. A change in the domestic help situation in postwar years together with the whole American trend away from the servant regime, might alter some plans for kitchen progress. One thing the contest proves conclusively is that women are keenly interested in their kitchens, and alertly critical in their attitude on future developments.

Public Service—Plus

From an editorial in the Bergen, N. J., *Evening Record,* Sept. 21.

This writer has frequently damned, figuratively at least, all of those public services which the hurricane and its destructive forces made him realize how much he needs in his ordinary and frugal daily living. He often has been irritated by their errors of omission and commission. He sometimes thought his bills were too high, and wanted to do something about it, although he never quite got around to doing it. But the hurricane caused him to miss the water when the figurative well ran dry. So now he is resolved to commend rather than condemn them, and he hopes it is not one of those New Year's resolutions made not to keep but to break.

But whether he does or does not keep it, Public Service, the phone company, and the public works departments of Hackensack and most other Bergen communities did a marvelous job with wartime man-power shortages in restoring taken-for-granted but now more fully appreciated services for their customers and taxpayers.

There was no New Deal legerdemain involved in the completion of their Herculean job. It was merely the application of a time-tried American formula for success in every human endeavor: constant application and hard work. So to ALL of those necessary civic services, both private and public, I want to say for myself and, I think, for a preponderant majority of the public here that we DO appreciate this most recent evidence of your efficiency and service to us and that we NOW appreciate you more because you served us most during the post-hurricane chaos. JOHN BORG
Publisher

Fatal Electrical Accidents Can Be Prevented

By D. C. Stewart

Member, Edison Electric Institute Accident Prevention Committee

THREE years' analysis of fatal accidents within the Electric Light and Power Industry tells a story that should be of the utmost concern to every person connected with the industry. The third annual analysis presented herewith supports and confirms the conclusions previously drawn from the two summaries already published in the BULLETIN. A study of the table, given below, shows that the patterns and proportions of fatal accident types and causes have been remarkably stable from year to year. Our principal accident enemies stand disclosed before us. We are in a position to turn the spotlight upon them and take their measure for an all-out attack.

Towering above all other accident types is electric shock and burn. Unless we can increase the striking power of our attack upon this arch enemy, the record indicates that seven out of every 10 men who will lose their lives from accidents in this present year or in future years, will be victims of this type of accident. Nothing can be done now for the men whose tragic experiences wrote the record of the past three years. But much can be done for the men who seem destined to die from the same familiar causes should we fail to translate the lessons of experience into action.

Strangely enough, this greatest of our accident enemies seems to be most vulnerable to attack. The weapons are known and at hand. They are simple, straightforward and few in number.

Study of the 252 electric shock and burn accidents occurring over the three-year period reveals that many of these accidents have a common denominator. Too many experienced, capable men, fully aware of the hazard to which they are exposing themselves, work within reach of unprotected energized conductors, relying as they do so upon their alertness, balance and skill alone to avoid contacts. The record indicates that in the long run this judgment is faulty. If progress is to be made, each organization must answer fairly this question. "Which shall prevail with us, individual judgments or the dispassionate, factual verdict of the record?"

In short, the heart and core of prevention lies in a course of action based upon recognition of the importance of an axiom which stems directly from tragic experience.

IF ENOUGH MEN, NO MATTER HOW ABLE AND EXPERIENCED THEY MAY BE, OVER A LONG ENOUGH PERIOD OF TIME, ASSUME POSITIONS IN PROXIMITY TO UNPROTECTED ENERGIZED PARTS SUCH THAT SOMETHING UNEXPECTED (A FALL, A SLIP, A CUTOUT, A MENTAL LAPSE OR A THOUGHTLESS ACT) MAY RESULT IN AN UNPROTECTED PART OF THEIR BODIES COMING IN CONTACT WITH SUCH PARTS, SOME OF THESE MEN WILL EVENTUALLY ESTABLISH CONTACT.

The tremendous importance of this axiom arises from the recognized fact that the odds are so high on any electrical contact resulting disastrously that we cannot afford to have a single one.

A six-point program, directed at the most outstanding unsafe practices will strike the enemy squarely and hard. These practices are:

1. Assuming positions with relation to unprotected energized parts such that some unexpected happening might result in contact.
2. Failing to wear rubber gloves when

CLASSIFICATION OF FATAL ACCIDENTS OCCURRING WITHIN THE ELECTRIC LIGHT AND POWER INDUSTRY DURING 1941, 1942 and 1943

		1941	*1942*	*1943*
Number of fatal accidents reported		134	128	122
Detailed reports submitted for analysis		121	121	117
Accident Type	*Location*			
Electric Shock or Burn	Line work on poles	52	50	41
	Line work on ground	14	5	10
	Line work in trees	3	0	1
	Line work at building	1	1	0
	Cable work underground	0	1	1
	At stations, on equipment, etc.	17	24	28
	Other miscellaneous	3	0	0
	Total	90	81	81
	Per cent	74.4	66.9	69.1
Falls	Line work, poles or ladders	8	6	5
	Line work in trees	0	0	3
	Steam plants	1	7	5
	Hydro plants	1	1	0
	Substations	0	3	1
	Other miscellaneous	1	2	0
	Total	11	19	14
	Per cent	9.1	15.7	12.0
Motor Vehicles	Highways	4	8	2
	Railway Crossings	4	2	1
	Steam Plants	0	1	0
	Total	8	11	3
	Per cent	6.6	9.1	2.6
Falling, Flying, Moving Objects	Line Work	3	5	3
	Steam Plant	1	1	4
	Total	4	6	7
	Per cent	3.3	5.0	6.0
Burned	Steam Plant	2	3	4
	Line Work—Manhole	0	0	1
	Total	2	3	5
	Per cent	1.7	2.5	4.3
All other types and locations		6	1	7
	Per cent	4.9	0.8	6.0

REVIEW AND CLASSIFICATION OF 117 FATAL ACCIDENTS REPORTED DURING *1943* WITHIN THE ELECTRIC LIGHT AND POWER INDUSTRY

Edison Electric Institute—Accident Prevention Committee

(This Summary was compiled from detailed reports submitted to the Institute. Coverage is approximately 95% of the 123 fatalities reported to the Institute for its annual statistical report)

ELECTRIC SHOCK OR BURN 69.2%	LINE WORK BUT STANDING ON SURFACE OF GROUND	CONTACTS ESTABLISHED WHILE CLIMBING OR IN WORKING POSITION BUT WITHOUT CUTTING OUT OR LOSING BALANCE	HANDS	Volts 220	Lineman	1.Working on 220/110 V secondaries below deenergized primaries. Shocked.
				2300	Lineman-Foreman	2.Placing fuse barehanded in cutout. Clip energized due to "backward" hookup.
				2300	Lineman	3.Stringing wires following storm. Shocked. No further details given.
				2400	Lineman	4.Refused transf. Pulled on pri. transf. lead to test broken bushing. Shocked.
				2400	Lineman	5.Removing protective equipment without gloves. Hand contacted 2400 V pri. wire.
				2400-4160	Lineman	6.Replacing primaries on pins. Grasped crossarm brace, energized through brace bolt.
				2400-4160	Lineman	7.Taping joints for transformer taps on primary. Tape broke down. Shocked.
				2400-4160	Line Foreman	8.Connected live sec. to transf. energizing primary. Later grasped trans. pri. lead.
				6900	Lineman	9.Closing cartridge with cotton gloved hand. Contacted fused disconnect.
				7620	Lineman	10.Guiding pole being lowered. Sec. snagged, flipped into pri. Hand on secondary.
				6380-11,000	Lineman	11.Using wire in place of ground set for grounding. Line alive. Short circuit occurred.
				6900-11,000	Line Foreman	12.Adjusting spill gap. Contacted 11 KV conductor, other hand on grounded spill gap.
				13,200	Serviceman	13.Checking sec. connection. Touched terminal, at same time contacting cut out terminal.
			HEAD OR BODY	2200	Lineman	14.Climbing. Wire hook on belt caught in line. While freeing self established contact.
				2300	Lineman	15.Working on sec's. While changing position head contacted primary conductor.
				2300-4000	Lineman	16.Repairing line. Tie-in through meter loop on private premises had energized pri's.
				2300-4000	Lineman	17.Installing rope arm guy. Shoulders displaced blankets on adjacent pri. phases.
				4000	Lineman	18.Connecting overhead and underground pri's. at pothead. Contacted bare wire jumpers.
				2300-4100	Lineman	19.Replacing strain insulator. Contact to phase wire and accidentally grounded clevis.
				2300-4160	Troubleman	20.Climbing by energized line, contacted primary with shoulder. Fell 20 ft.
				2400-4160	Lineman	21.Installing temporary arc circuit support. Contacted riser and opposite phase wire.
				6900	Lineman	22.Inspecting and refilling oil in transf's. Back contacted 6900 volt riser.
				6900-11,950	Lineman	23.Moving transf. Climbed rapidly, shoulder contacted bottom of cutout. Fell 18 ft.
				6900	Lineman	24.Filtering oil in transf's. Details of how accident occurred not given.
				6900-12,000	Lineman	25.Checking for radio interference. Leaning back in "safety" touched 6900 V pri. wire.
				6900-15,000	Lineman	26.Installing jumper on de-energized line. Jumper slipped, shock & fall on 11 KV. line.
				44,000	Lineman	27.Climbed to be ready to connect jumpers when line was cleared. Contacted coiled jumper.
				66,000	Lineman	28.Pushing loop out with tie stick. Head contacted loop of conductor above.
				69,000	Lineman	29.Releasing U.S.Weather Bureau radiosonde from line. Contacted antenna of radiosonde.
				Not stated	Lineman	30.No witnesses. On trouble call, spur marks 10 to 12 ft. on pole. Burns on body.
			ARMS	2300	Lineman	31.Reached over wire to transfer other phase to new pin position. Arm contact.
				2300	Lineman	32.Repairing broken line following storm. Assumed line was "dead" but it was "hot."
				2300-4000	Lineman	33.Installing new cross arm and lowering 2 of 4 conductors to new arm. Arm contact.
			LEGS OR FEET	1300-2300	Lineman	34.Standing on arm. Knee touched conductor on arm above, where hose had been displaced.
				1150-4000	Lineman	35.Reading name plate. Contacted ungrounded neutral bus and grounded trans. case.
				4000-6900	Lineman	36.Replacing service wires. Descending, knee contact to trans. lead. Fell 25 ft.
		GAFF CUTOUT		4000-6900	Lineman	37.Cutout,foot contacting 6900 V wire. Fell across 6900 V phases, thence 21 ft. to ground.
		SLIP		2400-4160	Lineman	38.Inspecting crossarm. Foot slipped from crossarm brace, fell across primary wires.
		MISC. INSUFFICIENT DATA TO CLASSIFY ABOVE		115-230	Line Foreman	39.Working on 115 V wire from below with rubber gloves. Slumped. Shock doubtful.
				2200	Lineman	40.Splicing 2200 volt wire. Shocked. No further details of accident given.
				Not stated	Lineman	41.Skinning insulation from live lead, knife contacted ground. Burned by flash.
		ENERGIZED LINE WIRES		1300	Lineman	42.Felling pole. Tel. line snagged. Releasing line,shocked. Wire in contact with primary.
				1400-2300	Lineman	43.Reeling wire from line. Wire contacted st.lt.energized from accidental primary contact.
				2400	App'ce Lineman	44.Pulling wire over arm with hand line. Grasped wire which contacted live 2.4 KV wire.
				2300	Lineman	45.Removing 1 of 3 wires. Cut wrong wire at transposition.Grasped wire grip on "hot" wire.
		ENERGIZED TRUCK OR BOOM		2300	Lineman	46.Burying dead cow on rt.of way. Walking with cable from boom. Cable contacted primary.
				4400	Lineman	47.Attaching cable to pole to be raised. Steel boom was in contact with 4400 V wire.
				4000-6900	Line Foreman	48.Live wire caught on tractor-trailer truck.Freeing wire with pike pole,touched truck.
		TRANS.FAILURE		2760-4800	Lineman	49.Testing for sec.voltage at meter cabinet barehanded. Insulation failure pri. to sec.
		ST.LAMP CHAIN		6.6 A Series	Groundman	50.St.lt.trouble.Grasped insulator in lowering chain in contact with live mast arm.
		INS. FAILURE		44,000	App'ce Lineman	51.Connecting broken grd. wire to driven rod. Insulator on line flashed over to ground.
	LINE WORK IN TREE			2400	Lineman-Troubleman	52.Climbed tree to remove limb. Shoulder contacted pri.wire and he fell across sec.
	CABLE WORK UNDERGROUND			2780-4800	Cable Splicer	53.Had jumpered and cut trans.lead. Adjusting rope sling on lead,contact above glove.
				6900-15,000	Lineman	54.Removing current trans. Holding wire to check for length, wire contacted 11 KV bus.
				[illegible]	[illegible]	55.[illegible]
				Not stated	Substa.Operator	58.Removing winter enclosure from ventilator. Either fell into bus or explosion occurred.
		ENERGIZED		2400-4160	Lineman	59.Climbing to working area, contacted an uncovered section of adjacent live trans. lead.
				2900-4800	Electrician	60.Installing trans. in vault.Contacted live lead from pothead to cutout behind barrier.
				7200-12,500	Guard	61.Attempting to remove cat from structure with 6 ft. length of wire used as a poker.

	LINE WORK IN TREE		2400	Lineman-Troubleman	52.Climbed tree to remove limb. Shoulder contacted pri.wire and he fell across sec.
	CABLE WORK UNDERGROUND		2780-4800	Cable Splicer	53.Had jumpered and cut trans.lead. Adjusting rope sling on lead,contact above glove.
			6900-16,000	Lineman	54.Removing current trans. Holding wire to check for length, wire contacted 11 KV bus.
					55.Removing [illegible] contacted live [illegible] to live [illegible] contacted 22 KV. bus.
			Not stated	Substa.Operator	58.Removing winter enclosure from ventilator. Either fell into bus or explosion occurred.
	AT STATIONS WORKING ON OR AROUND EQUIPMENT BUS STRUCTURES ETC.	ENERGIZED LEADS,RISERS AND CABLES	2400-4160	Lineman	59.Climbing to working area, contacted an uncovered section of adjacent live trans. lead.
			2900-4800	Electrician	60.Installing trans. in vault.Contacted live lead from pothead to cutout behind barrier.
			7200-12,500	Guard	61.Attempting to remove cat from structure with 6 ft. length of wire used as a poker.
			22,000	Station Foreman	62.Changing trans.taps. Walked by "dead" bank climbed to live bank,contacted 22 KV lead.
			22,000	Sub-District Sup'r.	63 Installing meter on conductor. Reached over 2300 V bus,contacted 22 KV loop to fuse.
			23,000	El. Foreman	64.Checking oil circuit breaker. Reached above disconnect creating 3 phase short.
			Not stated	Maint. Electrician	65.Fighting fire in cables before they were deenergized.Short circuit occurred. Burned.
		DISCONNECTS	285	Electrician	66.Overhauling neutral breaker. Climbed above safe area to wipe live disconnects.
			13,200-22,000	Repairman	67.Climbed above protective grounds and contacted 22 KV switch. Shocked and fell to ground.
			57,000	Station Wireman	68.Painting structure. Climbed to inspect switch in the one energized bay of station.
			38,000-66,000	Station Operator	69.Overhauling 66 KV arresters. Climbed to sight for clearance. Contacted air break sw.
			76,400-132,000	Radio Engineer	70.Pulling test cable up to wave trap. Cable was dragged into live disconnect.
		CURR. OR POT. TRANS.	2200-4000	El. Maint. Man	71.Removing curr. trans. near breaker. Wrench struck grounded support.Short circuit. Burned.
			66,000	Lineman	72.Cleaning pot.trans. bushings. Hand contacted live terminal. Shock, burns and fall.
		LIGHTNING ARRESTERS	19,000-33,000	Meter Sup't.	73.Checking metering outfit. Climbed structure drew arc from weather cap of arrester.
			Not stated	Hydro Operator	74.Investigating sounds from lightning arrester. Touched metal shell of arrester.
		CIRCUIT BREAKERS	2300	Substa.Operator	75.Removing tank from breaker alive. Tank made contact. Burns from flaming oil.
			3950-6900	Substa.Operator	76.Cleaning circuit breaker cell. Contacted studs on cover and leads to breaker.
		FUSE	13,000	Electrician	77.Turning 10 ft.conduit for measurement. Conduit touched 13 KV fuses 9'6" above ground.
		POTHEAD	4160	Lineman-Splicer	78.Splicing leads to trans.bank. Reaching for lead,arm above glove contacted pothead.
		COMPENSATOR	Not stated	Aux. Operator	79.Started a motor driven exciter compensator by mistake. Explosion, burned by oil.
		METAL WALL	120	Watch Engineer	80.Touched man who was shocked from shower room enclosure in contact with light switch.
		66 KV EQUIP'T	66,000	Painter	81.Painting structure.Passed under barrier into live zone. Watcher temporarily absent.
FALLS 12.0%	STEAM PLANT	PLATFORM		Maint.Repairman	82.Barring coal clogged in chute from platform telescoper.Platform collapsed. Fell 10'.
		UNGUARDED FLOOR OPENING		Welder	83.Welding guard rail by open hatch-way. Fell through another nearby opening 39'.
		TURBINE RM.BASEMENT FLOOR		Operator-Engineer	84.Taking turbo-generator off line.Slipped and fell on floor. Died while on vacation.
		SCAFFOLD IN BOILER ROOM		Laborer	85.Lowering ventilating fan. Moving plank,stepped from end of scaffold. Fell 33'
		BOILER ROOM CATWALK RAILING		Fireman	86.To inspect coal hopper stood on wooden handrail of catwalk. It broke. Fell 23'.
	LINE WORK ON POLES OR LADDERS	GAFF CUTOUT		Lineman	87.Installing ground wire.While changing position cut out or slipped.Fell 30' to ramp.
		FALLING POLE		Lineman	88.Transferring sec's old to new pole. Bank caved off allowing pole to fall to ground.
		INSULATOR PIN		Lineman	89.Fastened safety around insulator pin, later removed pin. Fell 30' to ground.
		LADDER		Serviceman	90.Installing 3rd wire on service at building. Fell backwards from ladder on driveway.
		LINEMAN'S PLATFORM		Lineman	91.Installing substation at flour mill. Foot slipped from lineman's platform. Fell 22'.
	LINE WORK IN TREES	BROKEN ROPE		Tree Trimmer	92.Trimming trees. Was being lowered when rope broke. Fell 30' to ground.
		BROKEN LIMB OF TREE		Lineman's Helper	93.Trimming persimmon tree. Standing on 5" dia. limb which broke. Fell 14'.
		LIMB OF TREE		Lineman	94.On ground holding rope guiding tree limb.Rope caught.Thrown to grd. Cracked pelvis.
	SUBSTATION	WOOD BEAM		Lineman	95.Replacing insulator on air break switch. Walked along 6 x 8 beam, lost balance, fell.
FALLING, FLYING, SLIDING, ROLLING OR OTHER MOVING OBJECTS 6.0%	STEAM PLANT	COAL CHUTE		Laborer	96.Placing spilled coal on idle conveyor belt. Found buried in chute. Cause unknown
		COAL HOPPER		Conveyor Operator	97.Entered hopper to break stoppage of coal. Lost balance and was buried.
		COAL BUNKER		Ashman	98.Loosening coal in bunker. Arched coal broke loose. Was buried by slide.
		PRESSURE TANK		Welder	99.Testing water filled tank by heating instead of hydrostatic test. Head blew out.
	LINE WORK	FAILURE OF OAK BEAM		Serviceman	100.Connecting trans. on 2 pole structure. Timber broke. Struck by falling trans.
		FALLING POLE		Lineman	101.Pulling poles with truck A frame. Pole "top heavy" fell, bounced and crushed lineman.
		DYNAMITE EXPLOSION		Laborer	102.Drilling with jack hammer in exploded hole, struck an unexploded shot.
BURNED 4.3%	STEAM PLANT	BOILER DRUM		Helper	103.Washing down drum. Steamfitter opened valve on main steam line, scalding workman.
		BOILER DRUM		Helper	104.Same as 103, double fatality.
		PULVERIZING MILL		Watchman	105.Fire in mill. Exhauster shut down. Negative pressure blew open inspection door. Burned.
		BOILER FLARE BACK		Mechanic	106.Shielding welders arc with blanket, installing duct connection. Boiler flared back.
	LINE WORK	MANHOLE		Cable Splicer	107.Sampling water in cable ducts. Arc ignited gas forced thru duct by water. Burned.
MOTOR VEHICLES 2.6%	HIGHWAY	COLLISION OF VEHICLES		Clerk	108.At slight curve in road collided with large tractor-trailer truck. Cause unknown.
				Ass't Elec.Eng'r.	109.Ascending hill. Struck rear of trailer truck loaded with steel rods. Cause unknown.
	RAILWAY	STRUCK BY TRAIN		Meter Reader	110.Drove pick-up truck from side road, up incline and into path of freight train.
DROWNED 2.6%	HYDRO PLANT	FLASH BOARDS ON DAM		Foreman	111.Replanking log sluice. 50' of flash boards "lifted" from bottom. Washed over dam.
		FLASH BOARDS ON DAM		Carpenter	112.Same as 111, double fatality.
	STEAM PLANT	FLOOR OPENING		Ass't Watch Eng'r.	113.Inspecting drain pipes into intake canal. Fell through floor opening into canal.
CAUGHT BET.	STEAM PLANT	COAL LORRY		Maint. Man	114.Climbed ladder to talk to man in boiler.Crushed bet. coal lorry and end of hopper.
FROZEN	HIGHWAY	BLIZZARD		Operator	115.Car stalled in drift. Became exhausted walking from car to plant during blizzard.
SHOT	SUBSTATION	SUBSTATION GROUNDS		Operator	116.Accidentally shot (coroner's jury statement) while supposedly patrolling grounds.
SILICOSIS	STATION	SENTRY BOX		Watchman	117.Shifted sentry box. Aggravation of previously existing lung silicosis condition.

Compiled for EEI Accident Prevention Committee
by D.C.Stewart, September 1944.

within reach (including falling reach) of wires or parts which are or may become energized at primary voltages.

3. Failing to apply rubber protective equipment to wires or parts which are or may become energized at primary voltages when within reach (including falling reach) of such wires or parts.

4. Failing to cover secondaries or other grounded objects when they are so spaced with relation to primaries that the workman's body can bridge from secondary or other ground to primary.

5. Failure to set up or follow a hold-off system so formed as to insure that no one will begin work until the equipment to be worked on is positively known to be de-energized, that it is safe to begin work on it, and that it will not be energized while men are at work on it.

6. Failure to mark and clearly set off the safe working area from unsafe areas by tape, barriers, flags or other suitable markings.

Note that in all of these six points there is not a single one that is not already well known throughout the industry. Progress does not wait upon the discovery of some new magic principle, but upon new determination and a new crusading spirit which will not permit us to rest until we have eliminated these unsafe practices from our day to day work procedures.

The Accident Prevention Committee urges that each organization check over its past electrical contact cases and conscientiously ask itself, "Did any of these unsafe practices contribute to the accident; if so, what have we done to prevent a recurrence?"

Then go right on to the next and more important step. Take this step regardless of whether or not you have had electric contact cases, because your men work every day under the shadow of these averages and your freedom from this accident type may be fortuitous. Critically examine present work procedures to discover and correct these six unsafe practices wherever they may be found. Hundreds of millions of man-hours of experience have demonstrated that they are the raw materials which now go into the making of most of our fatal electrical contact accidents. Eliminate the raw materials and you will automatically eliminate the undesired finished product.

NOTE: Reprints of this article and accompanying chart are available from the Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y.

The Excess Profits Tax

(*Continued from page* 306)

With respect to the first: In spite of the net increase in electric utility plant investment during the last four years of $1,171,000,000, the net income for the stockholders has decreased by $24,000,000 during the period. As to the second: In the face of an increase of $336,000,000 (or 95 per cent) in taxes, and a 27 per cent increase in hourly rates of pay to electric utility employees, in the four years ending 1943, the average unit price at which all electricity was sold in 1943 was 23 per cent below the average figure for 1939.

These figures, showing how our stockholders and our customers have fared during the war, are brought into bold relief by comparison with general industrial conditions: During the same period (from 1939 to 1943) the net profits after taxes of manufacturing corporations, as reported by the U. S. Department of Commerce, increased $3,086,000,000 or 120 per cent; wholesale commodity prices increased 34 per cent; and average cost of living increased 22 per cent.

The kernel of the situation was expressed in the opinion of the Supreme Court of Michigan, May 17, 1944, in ruling on the appeal to it of the decision of the Public Service Commission of that State in the Detroit case, wherein it said:

"The public should not be required to pay rates that will yield an extraordinary profit to the utility and the stockholders of the utility, on the other hand, are at all times entitled to a fair return on their investment."

As shown by the figures already given, the stockholders of electric utilities as a whole are earning less on their investment now than before the war. So the matter boils down to two queries: (1) Whether temporary utility excess profits, as defined in the Revenue Act, which the facts show to be due purely to war conditions, shall be taken from the financing of the nation's war effort which produced them, and (2) whether temporary war conditions are a fair basis for rate reductions, when present stockholder returns are below prewar levels and when rate reductions made now would inevitably reduce stockholder earnings still further after the war emergency passes.

Production of Civilian Goods Is Still Above 1938 Levels

PRODUCTION of civilian goods reached its lowest point about a year ago, when that of war materials was approaching its peak, according to statistics from the U. S. Department of Commerce. As shown by the following table, civilian output increased slightly last Fall and has since remained fairly stable. For the second quarter of 1944, production of civilian goods was 85 per cent of the 1935-39 average, as compared with 82 per cent for the second quarter of 1938. At the same time, the civilian population is some 6 per cent smaller than it was in 1938.

Output of War and Civilian Goods
(Seasonally Adjusted; Expressed as Percentages of 1935-39 Average)

	War Production	*Civil Production*	*Total Industrial Production*
1942			
1st quarter ..	78	105	183
2nd quarter..	101	90	191
3rd quarter..	117	86	203
4th quarter..	135	84	219
1943			
1st quarter ..	149	82	231
2nd quarter..	159	79	238
3rd quarter..	163	79	242
4th quarter..	159	86	245
1944			
1st quarter ..	156	87	243
2nd quarter..	152	85	237

Progress Report No. 3

Fundamental Investigation of Graphitization of Piping

CONDUCTED BY JOINT EEI-AEIC SUBCOMMITTEE ON GRAPHITIZATION OF PIPING
L. E. HANKISON, T. E. PURCELL, ALEX D. BAILEY, *Chairman*,
SABIN CROCKER, *Secretary*.

August, 1944

TWO previous progress reports on the "Fundamental Investigation of Graphitization" have been distributed in mimeograph form to those directly interested and published in the October, 1943, and April, 1944, issues of the EDISON ELECTRIC INSTITUTE BULLETIN. The first report covered the preliminary field survey of graphitization of piping which demonstrated the need for a fundamental investigation. A detailed outline of the program to be carried out at Battelle Memorial Institute was published in connection with the first report. The second report reproduced the 10 questions which formed the basis of that program, described the work in progress at Battelle, classified the degree of graphitization reported for some 38 different piping systems, and called attention to the desirability of limiting the extent and duration of swings above design temperatures.

In this, the third report, the work at Battelle is described and a digest is presented of statements from various laboratories and independent investigators obtained through a request for a brief outline covering the investigations they had under way on graphitization and any findings they cared to reveal. The response has been most gratifying and the various nebulous ideas as to the causes and methods of avoiding graphitization are gradually assuming more substance. An effort has been made to relate the Battelle findings and the conclusions of the independent investigators to the 10 questions which form the basis of the fundamental study. In particular, suggestions and tentative recommendations are made on the following points:

(a) Best stress relieving temperature for welds.
(b) Restoration of partially graphitized joints.
(c) Specification of pipe material for 850 F to 950 F service.
(d) Specification of casting material for 850 F to 950 F service.
(e) Heat treatment of pipe and pipe bends prior to installation.

Work at Battelle Memorial Institute

A comprehensive series of welded and unwelded specimens of carbon-molybdenum steels of both the high-aluminum and low-aluminum variety are being subjected to prolonged tests at 925 F, 1025 F and 1125 F. Previous to testing, all specimens were heated at 2200 F and air cooled to simulate conditions encountered in bending and upsetting pipe. Some specimens were then normalized by heating to 1650 F and air cooling. The unwelded specimens were stress relieved by heating at 1200 F, 1300 F, 1350 F, 1400 F, and 1500 F. The single-bead welded specimens were tested "as-welded" and after stress relieving at 1200 F, 1310 F and 1380 F. The same procedure was followed with single-bead welded specimens of carbon steel, except that the stress-relieving temperatures were 1200 F, 1290 F and 1370 F in order to bracket the critical temperature which was about 1315 F. In all, some 185 bars approximately ½ to 1 in. thick, 1 in. wide, and 6 to 8 in. long are being tested. The bars are placed in pipes with caps screwed on the ends to protect them from the furnace atmosphere. A ⅜ in. microspecimen will be cut from each bar at 500, 1500, and 3000 hour intervals.

The 500 hour heats have been completed on most of the specimens and microscopic examinations are being made. The 1500 hour heats have been completed on about one-half of the specimens and the following results have so far been reported. No graphite was found in any of the carbon-moly specimens examined at the end of 500 hours at 925 F, 1025 F or at 1125 F. The high-aluminum samples in many cases, but not in all, showed some general graphitization after 1500 hours at 1025 F and at 1125 F. The low-aluminum samples did not show any positive evidence of graphite after 1500 hours at 1025 F and at 1125 F. About the same amount of graphite was developed at 1025 F as at 1125 F. No graphite was found in any of the carbon-moly samples at the end of 1500 hours at 925 F. Plain carbon-steel samples have not been reported on as yet. Graphitization of the carbon-moly specimens did not appear to be influenced by the heat effect of the single-bead welds. A welded joint between unused short lengths of high-aluminum and low-aluminum carbon-moly pipe has been made up by The Detroit Edison Company for use in the Battelle investigation.

Statement on Independent Investigations

A digest of statements on independent laboratory investigations is appended to this report. These statements were obtained in response to letters sent out early in May to representatives of organizations understood to be investigating graphitization.

The value of reports and statements of these investigators cannot be overemphasized. Among the more significant conclusions from the data presented are: (1) that microstructures produced by heating at about the lower critical temperature are the most prone to graphitization; (2) that the heat-treatment of pipe during the manufacturing and fabricating processes has an important bearing on subsequent graphitizing tendencies; and (3) that segregated graphite can be dissolved by heating above the upper critical temperature, but that such treatment will not necessarily inhibit subsequent graphitization. Many other points, such as the possibility of checking the graphitizing tendency of new steel by chemical analysis, may ultimately prove important steps in the solution of this problem.

Recommendations and Suggestions

The following recommendations and suggestions on five specific questions are based on a preliminary evaluation of the data so far obtained:

(a) *Best Stress Relieving Temperature for Welds*

Although data have been presented which indicate that a 1300 F stress relieving treatment will not entirely prevent the subsequent formation of graphite, the general weight of evidence is that it tends to retard graphitization and may even prevent it entirely at usual operating temperatures. Until proved otherwise, it would seem desirable to stress relieve carbon-moly welds at 1300 F.

(b) *Restoration of Partially Graphitized Joints*

Tests have demonstrated that graphite in a carbon-moly welded joint can be successfully put back into solution by heating at 1650 to 1750 F. The evidence that the resulting structure will be sufficiently stable to warrant such a restoration treatment is not conclusive however. Further tests plus actual trials on a weld in position will be needed to demonstrate whether partially graphitized welded joints can be restored. Where graphite of the chain or segregated type exists, restoration by heating has not proven successful.

(c) *Specification of Castings for 850 F to 950 F Service*

The interest of valve manufacturers in the subject of graphitization has been intensified by the discovery of two cases of segregated graphite in carbon-moly valve-body castings. The tendency to specify lower aluminum additions as a preventive of graphitization has caused concern as to the foundry's ability to produce sound castings when so restricted. The addition of chromium to carbon-molybdenum castings in amounts of ½ to 1 per cent as a graphite inhibitor with the retention of aluminum for deoxidation in amounts up to 2 lb per ton is advocated by some valve manufacturers. Keel blocks of castings produced to this specification will be supplied to Battelle for test purposes. The need for a comprehensive investigation of the effect of aluminum and other deoxidizing agents on the castability of various compositions and on the resistance to graphitizing has been called to the attention of the Manufacturer's Standardization Society of the Valve and Fittings Industry.

The proposed composition is similar to Grade C3A of ASTM Specification A157, except for a reduction in chromium content from a range of 1.50-2.25 per cent to 0.50-1.00 per cent. In order to insure weldability, it may be desirable also to reduce the carbon content and specified tensile strength to make it more nearly comparable with Grade WC1 or WC4 of ASTM Specification A217. Whether the resulting composition has any economic or other advantage over the chromium-nickel-molybdenum analysis covered by Grade WC4 of ASTM Specification A217 remains to be determined. The latter composition has shown no tendency to graphitize even at temperatures around 1100 F.

Since the addition of an alloy to castings does not increase their cost proportionate to the increase in cost of pipe for an equivalent alloy addition, it seems desirable to suggest alloy materials for valves at lower temperatures than in the case of pipe. In selecting castings for a new installation it would seem desirable to keep below the following temperature limits for the respective alloys:

Carbon-moly	825 F
Low-aluminum carbon-moly	925 F
Chrome-moly or Chrome-nickel moly	950 F*

Operating swings should not exceed the above temperatures by more than 25 F.

(d) *Specification of Pipe Material for 850F to 950 F Service*

Two instances of dispersed graphite have been reported for the low-aluminum variety of carbon-moly pipe, i.e., pipe deoxidized with about 0.5 lb of aluminum per ton. While such pipe apparently is much more stable than the high-aluminum variety and probably can be considered satisfactory if the operating temperatures never exceed 925 F, some further assurance is desirable for 950 F service. One proposal is to eliminate aluminum entirely on the basis that no case of graphitizing in an aluminum free steel has been discovered. A further requirement for such a steel is that it should have a McQuaid-Ehn grain size of 1 to 5 and show a "normal" structure. As a further safeguard, it is proposed to add 0.50 per cent chromium.

A second proposal is to add 1 to 1½ per cent chromium and permit aluminum additions up to 1½ to 2 lb per ton. This is advocated by some pipe manufacturers on the basis that less difficulty would be experienced with surface defects with the higher aluminum additions.

A third proposal is to add 0.50 per cent chromium to the analysis for carbon-molybdenum pipe in ASTM Specification A206 and require that not more than ½ lb of aluminum per ton shall be used for deoxidation.

In order to conform to an established composition, chromium-molybdenum pipe for a recent 950 F installation has been ordered to Grade T12 of ASTM A213, with the provision that chromium should be near the low side of the 0.80 to 1.10 per cent range and that the aluminum addition should not exceed 0.50 lb per ton.

Samples of chromium bearing steels will be tested at Battelle to confirm the general impression that they will not graphitize.

In selecting pipe for a new installation, it would seem desirable on the basis of present information to keep below the following limits for the respective materials:

Carbon steel, low and medium carbon	825 F
Low-aluminum carbon molybdenum (0.5 lb per ton)	925 F
Chrome-molybdenum (½ to 1 per cent Cr)	950 F**

Operating temperature swings should not exceed the above temperatures by more than 25 F.

(e) *Heat Treatment of Carbon-Molybdenum Pipe and Bends Prior to Installation*

While a partial spheriodizing treatment obtained by heating to 1300 F has been advocated as a preventive of graphitization, and a treatment at 1400 F has been suggested as a means of avoiding the segregated type of graphite, it is believed that for the present a normalizing treatment by heating to 1750 F and cooling in air is to be preferred. The creep strength of the coarse grained Widmanstatten structure produced by normalizing the low-aluminum variety of carbon-moly is believed to be superior to that resulting from the other treatments and if the operating temperature is limited to 925 F the possibility of graphitization of such material is rather remote. A normalizing treatment presumably will be suitable for the chrome-molybdenum pipe, but the exact temperature required will depend upon the particular analysis chosen.

* Higher temperatures may be found permissible later for these materials having chromium additions.

** Higher temperature may be found permissible later for chrome-molybdenum pipe.

APPENDIX TO PROGRESS REPORT NO. 3

Digest of Statements on Independent Laboratory Investigations

The following information was obtained in response to letters sent out early in May to representatives of a number of organizations known, or thought, to be conducting research on graphitization.

The Babcock and Wilcox Company

Mr. H. J. Kerr reported that their efforts have been concentrated on materials which do not appear to be susceptible to graphitization. They have not been able to graphitize carbon-moly steels in which no aluminum was used for deoxidation and/or those having a normal McQuaid-Ehn with a grain size of 1 to 5.

Mr. Kerr does not think that the low-aluminum variety of carbon-moly now furnished to ASTM A206, can be considered immune from graphitization. However, the additional requirement that A206 material shall be "normal" on the standard McQuaid-Ehn test with a grain size of 1-5 was thought to insure immune material for 950 F service. As an additional safeguard B & W is adding one-half of one per cent of Chromium to castings and forgings intended for 850 F to 950 F service.

Mr. Kerr pointed out that the welding heat reduced the grain size of the Springdale pipe which had been coarsened by heating for upsetting. Graphite was precipitated in this fine-grained region. On either side of this region the material did not appear to be susceptible to graphitization. He had not been able to graphitize the large-grain-sized structure in the Springdale upset end without either welding or normalizing at 1650 F or 1750 F.

They will make every effort to avoid the dispersed type of graphite although he was not at all sure that it will form the chain type, since orientation of the chain type is considered to be dependent on the grain size and structure of the base metal.

Bureau of Standards

The reply of Mr. T. G. Digges indicated that no work on graphitization was being conducted at the Bureau of Standards.

Climax Molybdenum Company

From Mr. A. J. Herzig's reply it appears no work is being done on the specific problem of graphitization by Climax Molybdenum. However, attention was called to two papers on the partition of molybdenum in iron-carbon-molybdenum alloys which were presented at the ASM Conventions of 1942 and 1943 and a third paper dealing with diffusion of molybdenum to be presented at the 1944 ASM Convention. These papers were considered to offer assistance with respect to the fundamental problem of graphitization.

Consolidated Gas Electric Light and Power Co. of Baltimore

Mr. H. N. Boetcher reported that in addition to routine checks of piping in service they were thoroughly examining a length of high-aluminum carbon-moly pipe which was found to have a relatively large amount of random graphite present throughout the pipe. Indications were that this pipe had a course spheroidal structure when installed. A number of specimens are being examined which have been held at 1100 F for periods up to 7500 hours. Decarburization has made some specimens useless and may have affected the degree of graphite development in others. They propose to examine pieces of low and high-aluminum killed pipe after heat treatment to produce various grain structures. Heating cycles at 1100 F and 1300 F are contemplated.

Inconsistent results have been obtained in heating above the critical temperature for re-solution of graphite. They are studying effect of various types of graphite on impact values. Large amounts of metallic aluminum have been found in pipe susceptible to graphitization. Aluminum oxide does not seem to be related to graphitization tendency.

The Detroit Edison Company

The reply of Mr. I. A. Rohrig outlined three investigations on graphitization of carbon-molybdenum pipe now under way. The first dealt with joints in Springdale pipe, one side of which has been normalized at 2250 F and the other at 1750 F, welded with 25 chromium-20 nickel, and carbon-molybdenum electrodes. After soaking for 2000 hours at temperatures ranging from 1000 F to 1200 F, it was found that more graphitization had occurred in pipe normalized at 1750 F but that no segregated graphite had been produced. Furthermore, less graphite was found in the heat-affected area adjacent to the 25 chromium-20 nickel weld than in the carbon-molybdenum weld. A carbide band had developed at the edge of the 25 chromium-20 nickel weld indicating carbon absorption from adjacent base metal, and in this depleted area no graphite had formed.

The second investigation covers samples from joints between different types of carbon-molybdenum pipe and also between pieces of the same type of pipe which had been subjected to different normalizing treatments. Joints were made with both 25 chromium-20 nickel, and carbon-molybdenum electrodes. They were subsequently subjected to different drawing and normalizing operations and are now being tested at temperatures alternating between 1000 and 1100 F. No results are yet available from this investigation.

The third investigation covers the examination of medium-carbon steel pipe which had been subjected to an operating temperature of 835 F for approximately 64,000 hours. It indicated that graphitization is strongly influenced by segregation in the pipe metal parallel to the longitudinal axis. No segregated graphite was found adjacent to the heat-affected zone, however. The suggestion was made that the Battelle investigation might consider the effects of dissolved gases upon graphitization of steels manufactured by different methods.

General Electric Company

Mr. S. H. Weaver reported that an extensive program was under way. A furnace with a constant temperature of 1300 F at one end tapering to 900 F at the other is loaded with 80 unstressed bars, 24 inches long of one square inch cross section. The influence of various percentages of manganese, silicon, aluminum, alumina, and other constituents on time to graphitize is being studied. Samples of unused carbon-moly, both high and low-aluminum, are included in the investigation. All bars have been removed for examination after 2000 hours at temperature. No results were given.

In addition all rupture-stress test bars with 5000 hours or more at temperature are being examined for graphite.

The M. W. Kellogg Co.

Mr. H. S. Blumberg advised that they were studying the resolution of graphite in carbon-moly joints removed from service and were investigating the effect of elevated temperatures on graphitization of welded joints in low-aluminum, high-aluminum, and chromium-molybdenum steels.

The Lunkenheimer Company

Mr. J. W. Bolton and associates A. J. Smith, H. Montgomery and J. Urban outlined the extensive investigation of factors influencing graphitization of carbon-steel, carbon-moly, and chrome-nickel-moly cast steels which is under way at Lunkenheimer. Their aim is to develop "graphitization immune" materials.

Slight initial differences in microstructure have been found to be all important. Samples of unused material were heat treated to produce fine and coarse grained pearlite and fine and coarse grained acicular structures. Heating 1200 hours at 1100 F produced some graphite in the fine and coarse grained pearlite structures of carbon-moly WC1 material, but none in the acicular carbon-moly structures. An additional 1000 hours, however, produced some graphitization of the acicular structures. No graphitization was produced in the chrome-nickel-moly WC4 material under parallel tests.

On tests being extended to 4096 hours, graphitization was more extensive in those samples already graphitized at 2200 hours. Even at this length of time graphitization still was not found in WC4 material.

Instead of welding, specimens were differentially heated and quenched in water to produce the entire gamut of structures encountered in a welded joint. Graphitization in carbon moly steels was found to occur most extensively in regions cooled from just above the lower critical temperature (about 1390 F). After 4096 hours at 1100 F the entire differentially quenched bars showed graphitization both microscopically and by chemical analysis, by analysis graphitization being nearly complete in the zone heated just to the critical, only partially complete at the ends.

The statement was made that the graphitized structure from both experimental and field service has consisted of carbide areas surrounded by free ferrite; none had been found with carbides homogenously dispersed. The increased solubility of carbon in alpha iron at 1390 F was noted and the opinion hazarded that such carbon held in solution on cooling might later precipitate out and thus nucleate graphitization.

From tests at 1100 F, 1200 F and 1325 F it was concluded that even 1100 F was too high to produce maximum graphitization in minimum time. Tests at 1025 F are under way. No graphite was obtained by heating a pipe end attached to the valve body from West End Station for 2000 hours at 1200 F and none was produced at 1325 F.

The suggestion was made that chemical analysis might be useful in the preliminary evaluation of steels as "graphitizable" or "non-graphitizable," since graphite has been found chemically where it could not be de-

tected microscopically. Steels in which carbon was thus found were subsequently graphitized by heating at 1100 F.

Two samples of carbon-moly steel which had been coarsely spheroidized by heating at 1300 F were subsequently graphitized by holding at 1100 F for 1032 hours.

Since graphitization is not the only undesirable possibility in steels, the elimination of aluminum in the deoxidation practice was not considered a satisfactory answer. Preference was expressed for the coarse acicular structure on the basis of creep strength.

University of Michigan

Dr. A. E. White's series of reports on his investigation of Philadelphia Electric Co. pipe contain the following findings:

(1) Heating samples of carbon-moly pipe graphitized by 35,000 hours at 900 F for 1000 hours at 1100 F and at 1200 F showed no significant increase in graphite in the zone affected by the heat of welding. Note: Specimens were sealed in evacuated quartz tubes in all of Dr. White's experiments.

(2) Graphite in zone affected by welding heat was successfully dissolved by heating for 2 hours at 1700 F. Heating at 1500 F and at 1600 F also caused complete resolution, but left carbides in concentrated condition.

(3) Sections cut through three planes demonstrated that graphite size given by usual cross section was true size.

(4) No difference was found in amount of graphite around the circumference of a position weld made on a horizontal pipe which could be attributed to different welding conditions. Less graphite was observed in the heat affected zone where the pipe metal showed a "lacy" type structure than where a Widmanstatten structure was present.

(5) From a study of effect of microstructure as produced by heating pipe to different temperatures, it was concluded that serious concentration of graphite in the heat affected zone occurred during service only when the adjacent pipe metal did not graphitize easily.

(6) New welds in used pipe as-welded, and after heating at 1200 F and at 1300 F were graphitized by heating 820 hours at 1100 F and 1200 F. No greater amount of graphite was produced by heating at 1200 F than at 1100 F. The lack of graphite concentration in the heat affected zone was attributed to the ease with which the "lacy" type structure of the pipe metal proper graphitized. The 1300 F 3 hours stress relief reduced the graphitizing tendency somewhat but did not prevent it. The pipe proper showed some graphite before the welding and heating tests were made. Additional tests at 1000 F are under way.

(7) Heating 820 hours at 1100 F reprecipitated graphite in the original locations, although not to the same degree, in specimens of badly graphitized carbon-moly which had been restored by heating at 1700 F for two hours. Specimens were tested as air-cooled from 1700 F and after heating at 1200 F and at 1300 F. Four hour treatments at 1200 F and at 1300 F caused spheroidization of the pearlite. Heating 820 hours at 1200 F on same samples did not result in graphite formation, but gave rather complete spheroidization. Tests at 1000 F are under way.

(8) Heating the specimens described under item 1 for an additional 820 hours, giving a total of 1820 hours at 1100 F, did not appreciably change the amount of graphite concentrated in the zone near the weld. The Widmanstatten structure, when in the pipe metal proper, appears to be more resistant to graphitization than fine pearlite or other structures examined.

(9) Examination of a weld after 43,100 hours at 900 F showed less graphite concentration than in a sample examined at the end of 35,000 hours. Structure of metal adjacent to weld was of the "lacy" type associated with heating just above the lower critical as contrasted with the Widmanstatten type which existed in the first samples.

Pittsburgh Piping and Equipment Co.

Mr. R. W. Emerson reported that additional examinations have in general borne out information he presented in the ASME-ASTM on Graphitization of Steel Piping, published April, 1944.

Public Service Electric and Gas Co.

Mr. F. P. Fairchild reported that they were attempting to sample each type of material used in their high-temperature steam and mercury vapor equipment. Out of a total of 40 joints sampled, graphitization of the segregated type has been found only in materials killed with approximately 2 lb. of aluminum per ton. Chemical analysis shows several times as much residual metallic aluminum in such steels as in the so-called silicon-killed materials. Aluminum-killed carbon-moly pipe and castings, with one or two exceptions show the segregated type in varying extent. The exceptions show an unusually wide heat affected zone; the most severe cases have a narrow heat affected zone. Two cases have been encountered where bend bars started to fail in the contact zone. A bend bar from the welding end of a casting started to fail at an outer fibre elongation of twelve per cent. Bend bars from a high-aluminum carbon molybdenum pipe to forging joint failed in the contact zone on the pipe side with a fibre elongation of eight and ten per cent, respectively. In both cases, the joints were cut out and rewelded.

Twenty-two specimens of unused materials and those in varying states of graphitization are being heated at 1000 F in a laboratory furnace. A few have been heated four hours at 1300 F as a preventive treatment. A temperature of 1000 F has been found to produce graphite of the segregated type in the weld contact zone of high-aluminum killed steels in approximately 1000 hours.

The Timken Roller Bearing Company

Dr. C. L. Clark reported that no experimental work on the problem of Graphitization has been done.

United States Steel Corporation

Mr. G. V. Smith referred to the closure of the paper by Smith and Miller which was published in the ASME-ASTM pamphlet on "Graphitization of Steel Piping," April, 1944, for data on their recent tests. Sections of Springdale pipe were normalized at 1650 F and at 2000 F. Single bead welds were made on either side of each pipe section at different rates, producing wide and narrow heat-affected zones. One half of each welded specimen was heated 4 hours at 1300 F. Graphite was observed in the specimen with the narrow heat-affected zone which had been normalized at 1650 F and not subsequently stress-relieved. No graphite was found in any of the other test specimens after 2000 hours at 970 F.

Vanadium Corporation of America

Dr. D. L. Edlund reported that they were still trying to develop a method for rapid production of graphitization of carbon-molybdenum pipe, so far without success. When this has been done, they plan to determine the effects of various elements on the rate of graphitization.

Westinghouse

Mr. N. L. Mochel stated that they have nothing to report at this time, but that they are starting additional work on this subject. He has also supplied Mr. T. N. Armstrong of the International Nickel Company with a sample of graphitized carbon-molybdenum pipe. He mentioned that there was some unconfirmed data available, and a subsequent inquiry developed that one of their investigators has an idea that the welding operation has much to do with the appearance of graphitization, but that this evidence was open to question, and was being rechecked.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF MARCH 3, 1933

Of EDISON ELECTRIC INSTITUTE BULLETIN, published monthly at Philadelphia, Pa., for October, 1944.

State of New York,
County of New York.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Wilgar Coleman, who, having been duly sworn according to law, deposes and says that he is the Editor of the EDISON ELECTRIC INSTITUTE BULLETIN, and that the following is to the best of his knowledge and belief, a true statement of the ownership, management . . . etc., of the aforesaid publication for the date shown in the above caption, required by the Act of March 3, 1933, embodied in Section 537, Postal Laws and Regulations . . . to wit:

1. That the names and addresses of the publisher, editor, managing editor and business manager are: Publisher, EDISON ELECTRIC INSTITUTE, 420 Lexington Avenue, New York City; Editor, Wilgar Coleman, 420 Lexington Avenue, New York City; Managing Editor, none; Business Manager, none.

2. That the owners are EDISON ELECTRIC INSTITUTE—not incorporated—trade association; C. W. Kellogg, President, 420 Lexington Avenue, N. Y. C.; Gilbert W. Chapman, Treasurer, American Water Works & Electric Co., N. Y.; Mae B. Woods, Secretary, 420 Lexington Avenue, N. Y. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

WILGAR COLEMAN,
Editor.

Sworn to and subscribed before me this 29th day of September, 1944.

(Seal) MAE B. WOODS,
Notary Public, Queens County.
(My commission expires March 30, 1946)

Linemen Cutouts

A Survey and Analysis of Causes with Recommendations for Preventive Measures

By H. H. Berman

Consolidated Gas Electric Light & Power Co. of Baltimore

ACKNOWLEDGMENT: Safety Engineers of Electric Light and Power Companies in various sections of the United States and Canada aided in the making of this study which was undertaken as a subcommittee activity of the EEI Accident Prevention Committee. Whatever benefits are derived from the drafting of this report on Linemen Cutouts have been made possible through unstinted cooperation on the part of these Safety Engineers.

MENTION of a lineman cutout accident generally brings to mind a vivid picture. Imagination focuses on a lineman hurtling down from a pole through space to land heavily on the ground near the base of the pole. While this may be termed a "popular misconception" of the true situation, nevertheless it is a fairly accurate, brief account of what actually happens with some degree of frequency to those men who use climbers to go up poles and do line work. Moreover, though it is fortunately true that such spectacular consequences do not follow every cutout, it is also true that serious injuries, fractures, dislocations and death result from lineman cutout accidents.

EEI Analysis Reveals

Analysis of the accident experience in the electric industry serves to emphasize the fact that linemen cutouts contribute to the present high severity rate. In 1941 and also in 1942 the official EEI tabulations of *fatal accidents* to linemen list cases where cutouts occurred.

The composite experience of these two years shows that 9 per cent of the fatalities listed under the heading "Electric Shock or Burn—Line Work on Poles" originated from cutouts, whereas of the cases listed under "Falls—Line Work on Poles" 40 per cent originated from cutouts.

This authentic statistical information means that *of every 11 cases where linemen suffer fatal electric shocks or burns while working on poles one of the accidents will originate from a cutout. And of every 10 cases where linemen fall from poles and sustain fatal injuries four of the accidents will originate from cutouts.* Furthermore, it is entirely possible that cutouts may have occurred and contributed to other cases listed in the EEI tabulations for the reason that unless a cutout was clearly established as a main factor in the accident sequence, the case was otherwise classified in the analyses.

It should be borne in mind that the EEI analyses referred to above were confined to a study of fatal accidents alone. The relation of cutouts to other than fatal cases remains to be established. In dealing with the experience of a particular group of workers, such as linemen, we can infer that where a factor is prominent in one class of accidents (fatals) it will very likely also prove outstanding in another class (nonfatals). Indeed, there are some grounds for the belief that among linemen, cutouts are the most frequent of all accidental occurrences. The problem of preventing this type of accident therefore qualifies as one of front-rank importance to light and power, telephone and telegraph and other companies employing linemen.

Linemen Consulted

This study was in its very early stages when it became apparent that linemen were the best source of information. So it was decided to consult them. And those fellows were ready, willing and did cooperate to the fullest extent. Linemen in different sections of the country were assembled in meetings and contributed greatly to this report by stating their opinions and views. Prideful of occupation, they freely discussed the problem of cutouts with unabated interest at the conferences. They voiced their individual, varied opinions in linemen's words and terms. These original expressions have been retained and used in this report. For instance, under the listings of cutout causes, many of their exact terms appear and are easily recognized. There are two reasons for using linemen's language: First, to give full recognition and credit to the linemen for the part that they have taken in this study of cutouts; and second, to make this report of greatest possible practicable use.

What Is A Cutout?

The initial problem presented at the conferences with the linemen was: What is a cutout? The ensuing developments were interesting, indeed.

Naturally, the linemen were thoroughly familiar with the subject of cutouts, some of them to their own painful, personal regrets. However, as the discussions progressed, it was somewhat surprising to hear some linemen state they had never experienced a cutout, while others frankly admitted that cutouts were frequent occurrences with them. Still others said a cutout was a rare thing in their personal experience. These commitments reflected a definite variance in the understanding or interpretation which the linemen placed on the term, cutout.

Subsequent development of the discussion indicated that a majority of the linemen interpreted a cutout accident as any cutout that results in the linemen getting hurt. In other words, they held that to constitute an accident a cutout must result in a reportable personal injury.

When the linemen were asked: Suppose one or both gaffs of a lineman's climbers suddenly come out of a pole or unexpectedly fail to go into the pole as intended but the lineman is not injured, has there been a cutout, their response was to the effect that there had been no accident at all—it was a "miss." They consistently viewed a "miss' like a walker regards a slip that does not make him fall.

Thus the linemen at first did not recognize that actually a miss is a cutout. They emphasized the fact that because no personal injury followed a miss, it rightfully qualified as a near-accident or an incident or belonged in some such unimportant category. They overlooked the possibility that in many cases the consequences of a miss could have been vastly different from what actually followed.

The safety engineer adopts a somewhat different viewpoint. He searches for the possible as well as the probable and actual consequences of an occurrence. To him a miss is an accident because there has been a sudden mishap inasmuch as the linemen's climbing or working has been unexpectedly interfered with. He further knows that regardless of resulting personal injury the cause and prevention of the accident are important. As a matter of fact, he dis-

cerns the same causes and factors underlying both misses and cutouts. Moreover, he realizes that for purposes of accident prevention the definition of a cutout must take into account the linemen's conception of a cutout and also embrace the so-called miss.

Continued questioning and discussion at the conferences brought about final agreement on the real meaning of the term. The definition evolved was: *A cutout is experienced when a gaff either fails to enter or fails to stay in a pole while a lineman is climbing or working on the pole and depending on the gaff for support at the time.*

Cutout Causes

The causes of linemen cutouts may be grouped under five general headings, namely:

I. Condition of Poles
II. Conditions on Poles
III. Clothing
IV. Climbers
V. Climbing Practices

These five general headings are discussed individually below. Actual cases are cited under the headings to illustrate how cutout accidents have occurred. Additional specific causes are then enumerated, many of which are stated in linemen's terms. Prevention as applied to the individual general heading is then discussed.

I. *Condition of Poles*

Case—"As this lineman was descending a distribution pole, one of his climbers cut out and he fell 12 feet to the pavement; his left leg was broken. *The surface of the pole was badly checked and was covered with deep gaff cuts.*"

Case—"This lineman was about to descend to the ground from the working position on the pole where he had been cleaning an incandescent lamp of a street lighting installation. After he had unfastened his belt and as he was about to shift his climbers, *a piece of the shell of the wood in which the gaff was seated broke out, causing him to lose his balance and to fall about 10 feet to the ground.* One rib was fractured, his chest was bruised and his right wrist was sprained. *The pole is of native cedar and it is weathered and checked.*"

Case—"One of this lineman's gaffs struck a knot while he was climbing a chestnut pole when he was about 12 feet above the ground. He cut out and slid down or fell down the pole. He broke the upper part of his right leg and injured right knee so severely that he may be permanently crippled."

These actual cases were chosen as typical instances wherein the condition of poles enters into the cause of some cutout accidents. Below are listed specific causes under this general heading:

1. Knots
2. Knotholes
3. Broken poles
4. Weather cracks
5. Freshly creosoted poles
6. Excessive gaff cuts
7. Splinters
8. Poles coated with ice
9. Rotten poles (outer layer)
10. Poles hardened by various preservative treatments
11. Crooked or leaning poles
12. Bird holes
13. Improperly guyed
14. Scaly poles
15. Poles splintered by lightning
16. Old gains and drillings
17. Flat surfaces on poles
18. Small and limber poles
19. Poles set too shallow in ground
20. Poles not properly tamped
21. Cemented bird holes
22. Hollow poles
23. Splits in poles
24. Frozen blackjacks (creosoted pine poles)

Prevention of cutouts from the condition of poles can be accomplished through proper control. For instance, a number of the above causes can be eliminated by the procurement of poles which meet a proper specification. Others of the causes can be removed through a good inspection schedule that will detect unsafe conditions and permit timely correction. Consideration should be given to the proper stepping of poles that are climbed frequently. Finally, linemen themselves can be made to realize that they should be on the lookout for all these circumstances and govern their behavior according to the conditions observed on a particular pole. Furthermore, they should report their observations.

II. *Conditions on Poles*

Case—"Lineman started up pole. As he set his left gaff at a point about 14 feet above the ground, he cut out and started to fall. He attempted to stop the fall by setting his right gaff. His right heel struck the stone curb. X-rays showed a fracture of the right heel and a fracture of the small bone in the right leg near the knee. Pole is excessively gaff marked. *Climbing space restricted by street lighting cable riser conduit and also by U. S. Government Mail Box at base of pole. Pole steps were not provided.*"

Case—"After a new cedar pole had been set, and after supply attachments had been transferred, the top of the old chestnut pole was pushed against, and lashed to the new pole, pending the transfer of telephone attachments to the new pole. As lineman was descending the new pole at the completion of the job, *one of his climbers struck a strain plate about 12 feet above the ground and he cut out.* He fell on his right side, rolling on his back. His back rested on the head of the hammer he carried in his belt. His back was severely injured."

These are but two of many actual cases involving cutouts from conditions on poles.

The following specific causes belong under the general heading of this section:

1. Conduit or cable on poles
2. Strain plates
3. Nails and tacks
4. Telephone wires bracketed to poles
5. Open ground wires
6. Pole steps
7. Signboards and posters
8. Too much equipment on pole
9. Metal pole numbers
10. Multiple street light switches on side of pole
11. Broken house knob screws driven into poles
12. Wasps' or bees' nests on poles
13. Meter equipment installed on pole
14. Guyhooks, lag screws and pole plates left on pole and not in use
15. Tree limbs too close to pole
16. Not enough climbing space between conductors and hardware on pole
17. Telephone attachments on jointly used po'es
18. Too many service drops from pole
19. Slack jumpers on pole
20. Telephone terminal cans
21. Vines on poles
22. Molding on small pine poles

Preventing cutouts from these causes is a matter that requires the attention of management and linemen. A number of these causes can be removed by planning installations and lines with due regard for the safety of the men who must climb the poles. When a pole is called a "clean" pole by linemen, the inference is that the equipment, fixtures and wires have been installed with sufficient climbing space. However, when the linemen observe unsafe or unfavorable conditions on poles, they should recognize the hazards, take necessary precautions to prevent possible cutouts and report such conditions to the proper supervisor.

III. *Clothing*

Case—"Lineman was climbing up pole. When he was at about 18-ft. height, cut out and fell. Pole was in good condition, but *his gloves were very greasy.* He stated he lost his hold as he was climbing."

Case—"Lineman had reached approximate position where he was going to work. He was in the act of passing his safety belt around the pole. As he reached around pole to grasp end of his safety, his left gaff cut out and he fell off the pole. *Ex-*

amination of left shoe revealed that the whole heel had come off."

These cases illustrate how cutouts can happen from clothing. Listed below are specific causes under this general heading which may produce or contribute to cutout accidents:

1. Greasy clothing or gloves
2. Worn or loose heels on shoes
3. Shoes with nailed soles or heels
4. Low cut shoes
5. Wrong size shoes
6. Loose fitting or ragged clothes
7. Wrong size gloves
8. Gloves with holes in them
9. Shoes too narrow for hooks
10. Wearing hooks over overshoes or boots
11. Soft soled shoes
12. Shoes with poor arch or ankle supports
13. Buckles on overalls
14. Wet clothing
15. Thin soles on shoes

Eliminating cutouts due to clothing is largely a responsibility that should be shouldered by linemen. Nevertheless, management can require that supervisors and foremen watch the kind of clothing which is worn by linemen. As a general rule linemen will appreciate having their attention directed to any unsafe condition of their personal clothing. In the exceptional cases it might be necessary to invoke stronger measures to effect the desired end.

IV. *Climbers*

Case—"Preparatory to the shifting of the location of a transmission pole which was side guyed against a slight corner, this lineman started to climb the pole for the purpose of attaching a rope guy while the steel guy would be temporarily removed. When the lineman was about 15 feet above ground level, he cut out and fell, apparently striking hard soil about eight feet from the foot of the pole. He broke his left hip, and his left forearm was broken close to the elbow; the position and condition of the arm fracture may produce a degree of limitation. The surface of the pole appeared to be in reasonably good condition, but it was noted that *the lineman's left gaff had been sharpened in duck bill shape, and several wood splinters were found to be held at the inside top edge of that gaff."*

Case—"Load conditions required the reinsulation of a 6600-volt substation tie line for 33,000-volt operation, and this major change made necessary other incidental changes; it required the changing of guy strain insulator deadends to disc deadends, at a pole, in the old 6600-volt circuit, supporting a 33-kv pole top type arc horn disconnecting switch. The section of line was lowered to the ground where the deadend assemblies were changed. Later, this lineman proceeded to anchor the deadend discs of one outside wire on the structural parts of the switch. Completing this, it was planned to deadend the other outside wire. He unfastened his safety belt and was swinging around the front of the pole, and when he had almost reached the new working position, the gaff of his right climber apparently cut out. He fell backward about twenty feet, his neck, shoulders and back being subjected to the full impact. His neck was broken, his left shoulder blade and ribs were broken, both lungs were punctured, and he apparently suffered internal hemorrhages; he received many body bruises; he died a few minutes after the accident. This employee's safety belt was in satisfactory condition, but *the gaff of one climber was loose."*

Case—"After he had pulled slack from an energized primary line and, apparently as he was preparing to descend to a slightly lower position before removing line hose from the line wires, this lineman cut out after he had unfastened his safety belt, and fell about 30 feet to the road, striking first on his hands and arms. His lips and chin were cut; teeth and lower jaw broken; both wrists, both arms, and his right leg were broken. He will be disfigured, and will lose much of the use of the right and left hands and right leg. *After the accident it was found that his gaffs were very short."*

Cases similar to those cited above appear with rather consistent regularity in the records. They serve to emphasize the importance of climbers in the prevention of cutout accidents. Here are twelve specific causes under this general heading:

1. Duck bill gaffs
2. Loose gaffs
3. Gaffs too short
4. Dull gaffs
5. Gaffs sharpened wrong
6. Straps too tight
7. Straps too loose
8. Broken straps
9. Bent gaffs
10. Wrong size climbers
11. Foreign objects under gaffs
12. Needle point gaffs

Prevention of cutouts from the causes under this general heading can be accomplished and every effort should be exerted to that end. However, no magic short cut can be evolved for the realization of the complete elimination of these causes. Instead, a carefully planned program must be put into operation along lines similar to those outlined below:

First, conduct rigid inspections of climbers including straps, leg irons and other steel parts, with particular attention being given to gaffs.

Second, standardize on an acceptable gage—one that is easily applied and is simple, not too complicated. Strictly enforce a regulation governing the minimum length of a gaff you will tolerate. If 1¼ in. is the minimum length, do not permit the smallest fraction below that length. Deal with gaff shape and size in similar stringent fashion.

Third, have a standard procedure for sharpening gaffs. There is universal agreement that gaffs should be sharpened with a suitable hand file. Grinding wheels are definitely tabooed for the purpose. But such agreement is not to be found relative to the person who is to be assigned the duty of sharpening gaffs. Exponents of central control think that the advisable method is to have the toolrooms or storeroom perform all sharpening and maintaining of gaffs in correct shape. Another suggested procedure is to require that foremen assume the responsibility for keeping gaffs in safe condition. Yet some linemen, perhaps a majority, contend that their own safety and personal interest dictates that they perform the sharpening. In their practical way they point out that where a gaff is accidentally broken on the job the most efficient procedure is for they themselves to restore the gaff to safe condition right on the location.

In reference to the actual sharpening of gaffs, it should be noted that some companies recommend placing the climber across the thigh with stirrup hooked around the thigh, the leg iron of the climber resting on top of the thigh, thus placing the gaff in a convenient position to file. Other companies require that the climbers be clamped in a vise thereby placing the gaff in a fixed position for the operation.

Fourth, educate linemen on the proper care of climbers, climber straps and buckles.

The aforementioned recommendations on climbers are considered practicable for adoption in companies employing few or many linemen.

V. *Climbing Practices*

Case—"Lineman was climbing 40-ft. cedar pole located at an intersection. The top crossarm carries three phases and neutral of a 4,000-volt feeder. Two bottom crossarms carry telephone wires. The pole is in good condition and is stepped practically all the way up. Lineman said he was climbing as is customary on a stepped pole, that is, he was using the steps for hand holds and putting his gaffs into the pole between the steel pole steps. He "guessed" he cut out at the very instant when his right hand was reaching up to the next step on his right and this left him without any hand hold. This happened at a point about 15 feet above ground. He toppled to his right and pitched head first toward the ground. In attempting to break the force of his fall he put out both hands and landed on his hands. He sustained fractured radius bone of both arms near wrist, and abrasion of nose and lower lip. Gaffs, climbers and straps were in safe

condition. *Lineman was known as a fast climber.*"

Case—"Lineman had climbed a transformer pole which was located about four feet from the edge of a highway and which was raked to the rear and to the road side. *He used the under side of the pole.* He completed his job and after unfastening his safety belt, *he started to descend to the ground using the same side (low side) of the pole.* About fifteen feet above grade he cut out and fell, landing on the highway. He suffered a badly broken right leg and right foot, a broken hip, broken back, broken left foot as well as injuries to his left arm, left wrist, left hand and left knee."

Case—"This lineman had been working for two weeks on an inventory party that was getting transformer name plate data. He kept a record of the number of poles that he climbed each day on the assignment. The accident occurred late in the afternoon on a very hot day. He had made more climbs than ever before accomplished by an employee in a single day. As he was descending a pole his right gaff cut out and he fell about 18 feet landing on the sidewalk. His right leg was fractured and he also sustained injuries to his back, as a result he is permanently disabled. When interviewed after the accident, the lineman stated *he had climbed so many poles that day he was just about 'all in' before he cut out.*"

The following specific causes are listed under the general heading of climbing practices:

1. Climbing or descending too fast
2. Using underside of pole
3. Fatigue
4. Gaffs not stuck in hard enough
5. Climbing too close to pole
6. Climbing through or past exposed conductors
7. Not watching where gaffs are stuck
8. Safety belt too loose
9. Sticking gaffs in pole at improper angle
10. Using too long steps in climbing or descending
11. Not inspecting pole before climbing
12. Inattention to climbing
13. Improper balancing of weight on gaffs
14. Belting to pole at wrong position
15. Physically unfit for climbing
16. Horseplay
17. Climbing too close to ropes and hand lines
18. Catching material thrown from ground
19. Placing hooks on ground wires
20. Failure to get good hand hold
21. Grabbing loose braces
22. Climbing in a mechanical manner
23. Sliding hooks when climbing—"Sneaking"
24. Showmanship—"Fancy Danning"

Elimination of these unsafe climbing practices must assuredly be based on sound thorough training of linemen in the safe way of handling themselves on poles. Such training should begin before the embryo lineman gets his "hooks" for the first time. Foremen should be required to watch the climbing practices of every lineman under their supervision and adopt necessary measures to correct any unsafe habits or practices that are observed. Experienced veterans as well as apprentice linemen need to be reminded from time to time concerning the pitfalls involved in committing uncalled-for and unsafe climbing practices.

Conclusions

The accident curve of the electric light and power industry can be brought down to a lower level by reducing the great number of cutouts experienced annually by linemen. To effect such reduction in the number of linemen cutouts, it is recommended that electric light and power companies project and continue safety programs embracing among other features those stipulated below:

Education of linemen and foremen in the causes and the means of preventing cutout accidents. The specific causes listed in this report constitute practical material that can be used in the conduct of safety conferences for linemen and foremen; and no doubt, the conferees in the course of their discussions will augment the number of these so-called causes.

Inspection and proper maintenance of poles, lines, electrical equipment and personal equipment such as climbers, belts and clothing. To have proper inspection and maintenance necessitates informed cooperation of management, supervisors, foremen and linemen.

Investigation of cutouts. Accurate and prompt determination of how the accident occurred, why it occurred and what should be done to prevent a recurrence will go far toward eliminating cutouts.

The recommended solution, therefore, amounts to the application of recognized prevention measures and procedure directed at 97 known and specific causes of linemen cutouts.

Electric Power Is Negligible in State and Local Postwar Planning

THE following table, condensed from the report of the Federal Works Agency, Major General Philip B. Fleming, Administrator, to the Special Committee on Postwar Economic Policy and Planning of the House of Representatives, shows the estimated cost, by type of project, of postwar plans as proposed by 1480 principal governmental units.

In this table, any plans for the development or expansion of electric service are included in the item of "miscellaneous public facilities." A check with FWA officials reveals that there were very few proposals involving municipal electric light, power or gas plants. Those actually proposed were very small and no separate segregation was made because they were unimportant in the sum total of proposed postwar projects.

COST OF PROJECTS: ACCORDING TO DEVELOPMENT

	(Millions of Dollars)							
Type of Project	*Total*	*%*	*Total*	*%*	*Total*	*%*	*Total*	*%*
Highways, roads, streets	176	18	352	20	786	21	1,392	22
Bridges, grade separations	92	9	120	7	320	9	428	7
Airports & facilities	28	3	61	4	151	4	270	4
Sewers, water, sanitation	258	27	463	27	860	23	1,277	20
Schools, educational	110	11	218	12	356	10	627	10
Hospitals & health	57	6	92	5	176	5	291	5
Other public buildings	54	6	74	4	208	6	670	10
Parks & recreational	50	5	74	4	185	5	419	7
Miscellaneous	144	15	296	17	659	18	923	15
Total Projects	$ 969	100%	1,750	100%	3,701	100%	6,297	100%

An Economist's View of "Planning"

Regimentation on the Fascist Model, Says Dr. Hayek, Can Evolve From It

By Henry Hazlitt

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THE ROAD TO SERFDOM. By Friedrich A. Hayek. With a Foreword by John Chamberlain. 250 pp. Chicago: University of Chicago Press. $2.75.

For American readers the significance of Professor Hayek's book lies in the fact that for every likeness he finds between the thought now current in England and the thought that raised hideous totalitarianism in Europe there is a corresponding likeness here between American and British thinking; and here also the same soothing idea as in England that there is a half-way place to stop.

There is no comparable book. It is written without passion or invective. Its impact upon the American mind ought to be terrific. If it is not, then we may believe that we are even further on that road than we think. G.G., in the *Economic Record*.

IN "The Road to Serfdom" Friedrich A. Hayek has written one of the most important books of our generation. It restates for our time the issue between liberty and authority with the power and rigor of reasoning that John Stuart Mill stated the issue for his own generation in his great essay, "On Liberty." It throws a brilliant light along the direction in which the world has been heading, first slowly, but now at an accelerative rate, for the last half-century. It is an arresting call to all well-intentioned planners and socialists, to all those who are sincere democrats and liberals at heart, to stop, look and listen.

Mr. Hayek, an internationally known economist, is a native of Austria. He was director of the Austrian Institute for Economic Research and lecturer in economics at the University of Vienna during the years in which Hitler was building up his instruments to seize power. He has lived in England since 1931, however, when he became Professor of Economic Science at the University of London. In 1938 he became a British citizen.

This experience has given him a type of insight not granted to the usual American or English economist or student of political affairs. "The following pages," as he writes, "are the product of an experience as near as possible to twice living through the same period. * * * When one hears for a second time opinions expressed or measures advocated which one has first met 20 or 25 years ago, they assume a new meaning as symptoms of a definite trend. They suggest, if not the necessity, at least the probability, that developments will take a similar course. It is necessary now to state the unpalatable truth that it is Germany whose fate we are in some danger of repeating."

But this danger, as Mr. Hayek sees it, comes from a direction far different from the one habitually suspected by the great bulk of "liberal" and "progressive" Americans and Englishmen. Whenever the latter think of the danger of fascism they always see it as coming from the conservatives. Whenever they write novels about the rise of an American dictator they always make him (in spite of our most outstanding native example of the type, Huey "Share-the-Wealth" Long), the darling of the chambers of Commerce. But it is no accident, Mr. Hayek points out, that in Europe so many of the leading Fascist leaders, from Mussolini downward (and not excluding Laval and Quisling) began as Socialists before they ended as Fascists or Nazis. As late as February, 1941, Hitler found it expedient to declare that "basically National Socialism and Marxism are the same."

Mr. Hayek's central contention, in brief, is that fascism, and what the German correctly call National Socialism, are the end products not of "nineteenth century liberalism" or of individualism, which represent their opposites, but of the growth of State control and State power, of national "planning" and of socialism.

Students of the currents of ideas (he writes) can hardly fail to see that there is more than a superficial similarity between the trend of thought in Germany during and after the last war and the present current of ideas in the democracies. There exists now in these countries certainly the same determination that the organization of the nation which has been achieved for purposes of defense shall be retained for the purposes of creation. There is the same contempt for nineteenth century liberalism, the same spurious "realism" and even cynicism, the same fatalistic acceptance of "inevitable trends." And at least nine out of every 10 of the lessons which our most vociferous reformers are so anxious we should learn from this war are precisely the lessons which the Germans did learn from the last war and which have done much to produce the Nazi system. * * * Although one does not like to be reminded, it is not so many years since the Socialist policy of that country was generally held up by progressives as an example to be imitated, just as in more recent years Sweden has been the model country to which progressive eyes were directed.

The supreme tragedy is still not seen that in Germany it was largely people of good-will, men who were admired and held up as models in the democratic countries, who prepared the way for, if they did not actually create, the forces which now stand for everything they detest. Few are ready to recognize that the rise of fascism and nazism was not a reaction against the Socialist trends of the preceding period but a necessary outcome of those tendencies. This is a truth which most people were unwilling to see even when the similarities of many of the repellent features of the internal regimes in communist Russia and National Socialist Germany were widely recognized. As a result many who think themselves infinitely superior to the aberrations of nazism, and sincerely hate all its manifestations, work at the same time for ideals whose realization would lead straight to the abhorred tyranny.

Mr. Hayek's book is so compactly written that it is impossible adequately to summarize the closely woven argument by which he seeks to prove this thesis. He shows how the very success of liberalism in the nineteenth century became the cause of its decline. The miracles of production and social advance to which it led caused the world to take this enormous progress for granted, to forget the policy of freedom on which it rested, and to become impatient because the unprecedented pace of progress was not still greater. Al-

though we had been warned by some of the greatest political thinkers of the nineteenth century, by de Tocqueville and Lord Acton, that socialism means slavery, we have so completely forgotten the warning that, even when this new form of slavery rises before our eyes, it scarcely occurs to us that the two things may be connected.

Mr. Hayek points out how England, the great center from which for more than two hundred years the world had been taking its political and economic ideas, became at about 1870 the importer of its political and economic ideas from Germany. He tries to point out how socialism by its very nature must be antiliberal and antidemocratic, and how national "planning" can seem to be successful only as it progressively removes all freedom of choice from the individual. He seeks to show how the individual must necessarily become enslaved because, as Leon Trotsky once put it, "in a country where the sole employer is the State, opposition means death by slow starvation." He argues that under a collectivist and totalitarian system the worst men get to the top—not by some horrible accident, but almost inevitably, because only such men will have the ruthlessness necessary to carry on a central plan to its logical conclusion.

Liberal opposition to "national planning" and socialism, Mr. Hayek insists, must not be confused with a dogmatic laissez faire attitude:

The liberal argument is in favor of making the best possible use of the forces of competition as a means of coordinating human efforts, not an argument for leaving things just as they are. It is based on the conviction that, where effective competition can be created, it is a better way of guiding individual efforts than any other. It does not deny, but even emphasizes, that in order that competition should work beneficially a carefully thought-out legal framework is required and that neither the existing nor the past legal rules are free from grave defects. * * * The fundamental principle that in the ordering of our affairs we should make as much use as possible of the spontaneous forces of society, and resort as little as possible to coercion, is capable of an infinite variety of applications.

The temptation to quote is irresistible, but it must be said that no one can realize the full force and persuasiveness of this book except by reading it through. Even if the author were not a foreigner by birth, one would say that his English style is remarkably fine. He has a gift for weighty aphorism. His tone is dignified, temperate and conciliatory. (As he writes in a preface: "My opposition to these (Socialist) views is not due to their being different from those with which I have grown up, since they are the very views which I held as a young man and which have led me to make the study of economics my profession.") It is a strange stroke of irony that the great British liberal tradition, the tradition of Locke and Milton, of Adam Smith and Hume, of Macaulay and Mill and Morley, of Acton and Dicey should find in England its ablest contemporary defender—not in a native Englishman but in an Austrian exile.

Herculean Efforts Restore Hurricane Damaged Service to Nearly Two Million Customers

DAMAGE by the hurricane of Sept. 14 to public utilities in some sections of New Jersey, New York and New England exceeded that of the great hurricane of 1938, which traversed for a considerable distance the same route as the later storm. Somewhat over a million and three quarter customers of 18 companies suffering the greatest damage in the coastal hurricane area from Virginia to Maine were out of service from a few hours to several days. Two companies reported 100 per cent severance over a short period. Outage percentages in other companies were in the following order: 99, 90, 87, 82, 74, 50, 50, 45, 40, 40, 30, 28, 20, 10, 5 and 4.

Herculean efforts of line crews, augmented in many cases by employees from other departments, restored a large number of the outages within 24 hours and by Sept. 20 all but 5 per cent of customers throughout the hurricane area were receiving service, some companies having completely restored connections. For the most part this 5 per cent represented customers with broken service connections, and located at some distance from distribution lines.

Hospitals and war plants had first priority on service restorations and suffered comparatively little inconvenience, all being restored the night of the hurricane or the following day at latest. Line crews, complete with equipment, were mobilized from unaffected areas as far west as Detroit, and many companies found it necessary to employ a number of additional tree-trimming crews.

Communication facilities were also severely crippled, and companies having short-wave radio equipment found it extremely helpful. One company was greatly assisted by a communication network consisting of radio-equipped jeeps supplied by the Army. Also, police radio facilities in many areas contributed to the handling of the emergency.

Some of the interesting comments from executives of affected companies on certain angles of restoration work follow:

"All our personnel worked through to the limit of their endurance. (That is, worked as long as they could, went home and got some sleep, and went back to work again.) Our working force is now about 60 per cent of normal. Therefore, aid of these outside construction crews comprising about 75 men was of tremendous benefit to us in preventing delays in restoration of service."

* * *

"Every available man was pressed into service to watch wires as the storm broke, act as messengers, and to make spot surveys of damage. Repair work during the storm was virtually impossible as the 80-90 mile wind defeated all attempts to use ladders or climb poles, and trucks were impeded by trees falling everywhere."

* * *

"City officials, police, fire, press and radio all very cooperative. Public attitude wonderful and very helpful under trying conditions."

* * *

"Having been forewarned about the approach of the hurricane the Company made arrangements in advance for materials and supplies, and the restoration of service was not at any time handicapped because of the lack of materials. The Company also made what arrangements it was possible to make for additional help, but for the most part the repairs to its system and the restoration of service were made by its own employees who worked long, hard, and faithfully during this emergency."

"Many of our employees had gained experience in the 1938 hurricane and probably the outstanding fact was the sustained effort they made to get the problem cleared up in the shortest possible time."

Fall Meeting of Accident Prevention Committee

H. O. Sprinkle, *Chairman*

THE fall meeting of the Accident Prevention Committee was held Sept. 12 and 13 at EEI Headquarters, Graybar Building, 420 Lexington Avenue, New York. The attendance was one of the largest in recent years.

A statistical report on the industry's accident experience for 1943 was presented by Mr. E. J. Kreh. This report, which covered the electric operations of 278 companies, showed a slight drop in the accident frequency rate over the past three years, but a fractional increase was noted in the severity rate. Copies of the report will be sent to participating companies and will also be available to others interested.

Mr. D. C. Stewart presented the results of his analysis of the reported 1943 fatal accidents. A copy of this will be included in the accident statistics booklet which will be distributed to safety supervisors shortly. (It also appears elsewhere in this edition of the BULLETIN.) Comparisons made with similar studies for the previous two years show that the causes of these accidents may be grouped as follows:

	Per Cent		
	1941	*1942*	*1943*
Electric Shock and Burns	74.4	66.9	69.2
Falls	9.1	15.7	12.0
Motor Vehicles	6.6	9.1	2.6
Falling, Moving or Sliding Objects	3.3	5.0	6.0
Burns (other than electric)	1.7	2.5	4.3
Other Miscellaneous Types	4.9	0.8	5.9

Material for a booklet on "The Fireman and Electrical Hazards" is being drafted by Mr. C. N. Rakestraw who has already collected considerable data on this subject. It has long been felt that there is a definite need for such a guide, particularly for firemen in rural and suburban areas to aid them in avoiding electrical hazards when fighting fires.

The second of a series of Information Exchange Bulletins containing summarized reports on unusual serious accidents or near accidents was presented by Mr. W. R. Smith. Mr. Smith is also sponsor for the resuscitation activities of the committee and spoke briefly on the latest developments in this field. He felt that the Eve Method of resuscitation had certain advantages in cases of prolonged submersion, especially in cold water, but considered the Schafer Prone Pressure and Pole Top methods more suitable for general public utility use.

Mr. W. T. Rogers, chairman of the subcommittee on Publicity, reported on the many encouraging responses received from operating executives and safety supervisors throughout the industry commending the committee for the series of letters and outline for safety talks that are being sent out. This material is based on data collected and analyzed by the Accident Prevention Committee and it is now being made available to the industry in this form as an effective aid in accident prevention efforts. Mr. Rogers is also arranging to reproduce in pamphlet form a selected list of outstanding papers on accident prevention subjects which will be made available to safety men in the industry.

Plans were also made to extend the educational work of the committee by scheduling the preparation of a number of sound slide films on selected subjects. Several committee members volunteered to prepare a film and the first two or three are expected to be ready for review and discussion at the next meeting. These films will deal with such subjects as safe practices during work on overhead lines, how to avoid station accidents, safe hold-off systems, and the effective use of tape, barriers, guards, etc., to designate unsafe areas.

The matter of placing returning service men was discussed with special interest. It was recognized that some of these cases will pose some new problems for safety men. The committee plans to keep in touch with developments and will consider this question further at its next meeting.

A proposal to recommend that the provisions governing the EEI Safety Merit Award be modified to provide for an award for each of the two following groups was endorsed:

(a) One million or more consecutive manhours without a disabling injury for electric companies or divisions with 100 or more employees.

(b) Five hundred thousand or more consecutive manhours without a disabling injury for electric companies or divisions with less than 100 employees.

A closed session under the leadership of Mr. George Diehl was a feature of the second day of the meeting. This session was devoted to a frank and helpful discussion of special problems met in accident prevention work.

Mr. Roy Godwin, reporting on the rubber goods situation, presented a summary report by Mr. T. R. Claffy and also told about the extensive work being done by the ASA Committee on Linemen's Rubber Protective Equipment.

An especially interesting paper on "How We Do It" was presented by Mr. C. B. Boulet. Mr. Boulet described the methods used in his company and declared that if there was any one thing more than another that contributed to the favorable record made by his company, it was the whole-hearted, active and energetic support of top management. A second paper in this series will be presented at the February meeting.

A report on "The Application and Care of Rubber Protective Equipment," prepared under the sponsorship of Mr. E. C. Rue, was referred to an editing subcommittee for review and publication. A first draft of a report on "The Use and Care of Pole Climbing Equipment" has also been completed by Mr. Rue. The report on "Linemen's Cut-outs," prepared by Mr. H. H. Berman, is expected to be published shortly.

A subcommittee was also appointed to consider ways by which appropriate accident prevention material might be made available to other groups for safety talks. It is also intended to assist interested program chairmen to obtain experienced speakers to present these messages.

Mr. H. J. Burton, a member of the Accident Prevention Committee, who has been assisting representatives of the Meter and Service Committee in the preparation of a manual on "Safe Practices for the Electric Meterman," reported that a final draft incorporating the ideas of both committees is nearing completion. He indicated that copies would be furnished to the members of each committee for any last minute suggestions they may care to offer before arrangements are made for publication.

Prospects that the War Production Board restrictions on the use of leather might be modified to permit more to be used in the manufacture of safety belts were not considered promising for the immediate future. It was reported however that an appeal from the provisions of the limitation order (M-310) would be considered by the Board where it can be demonstrated that webbing is inadequate.

Pennsylvania Electric Association Discusses Preparedness for Peace

INFLUENCE of present developments on the electric industry's peacetime future occupied members of the Pennsylvania Electric Association at the thirty-seventh Annual Business Conference held in Pittsburgh, Sept. 14. The theme of the meeting was "Our Future Is Now."

Col. Willard Chevalier, publisher of *Business Week,* was featured speaker at the evening session. He addressed the Conference on the subject, "Shall We Be Ready for Peace?"

In speaking of what we are to do with Victory, and the part that industry will play in the post-war program, Colonel Chevalier asked: "What do the American people ask of American industry? First of all, I think the people will ask that industry do its full share in maintaining a high level of employment . . . We must do our utmost to strike a sound balance between *security* for the mass of the people and *opportunity* for those who have what it takes to get ahead."

"Next in importance," he continued, "they ask that business use all of its abilities to maintain a *high level of production* . . . high-level employment is not worth much unless it results in high-level production."

A high level of efficiency has an important place in the future industrial picture as well.

The responsibility of seeing that industry does its job lies with each of us individually, Colonel Chevalier said. In industry itself it depends upon the energy and cooperation of capital, labor, scientific development, and business management.

Electric service, as one of the determining factors back of our successful war effort, was acclaimed in an address of welcome by A. W. Robertson, chairman of the board, Westinghouse Electric and Manufacturing Company. Mr. Robertson paid tribute to the utilities for their ability to furnish adequate electric power through all of the feverish period of war production.

In a "Report to the Industry," President P. H. McCance, Duquesne Light Company, stressed the long term planning which made it possible for the companies to respond to the demands of war. He enumerated some of the obligations and opportunities to extend the benefits of electric service which will accompany peacetime conditions. Mr. McCance gave a report of the various working committees of the association, discussed taxes and merchandising. "The future of the electrical industry," Mr. McCance said "depends upon our building now with ever-changing vision and enlarged focus."

Personalizing service to domestic consumers was emphasized by Fern Snider, Home Service Director, Georgia Power Company, in a talk on increasing domestic consumption in post-war. Miss Snider advocated larger scale sales promotion, the setting of a goal of full usefulness to communities served, and a more thorough educational program on adequate wiring and good lighting as a means of increasing potential electrical needs among domestic consumers. She pointed out that an increased domestic load must be created to take up some of the slack which will occur when war production ceases.

Judge Gay H. Brown, former Chief Counsel of the New York State Public Service Commission, discussed private enterprise as a philosophy rather than a mere catchword. Proposals for "electrifying the American way of life" were presented by Merrill E. Skinner, vice-president of the Buffalo, Niagara & Eastern Power Corporation. Mr. Skinner emphasized the need for recognition of the national scope of the electrical utility business, and the advantages to be gained by "collective load-building." He cited . . . the national advertising of associated electric utilities as a step in the right direction.

Application of the War Manpower Commission's "Training Within Industry" program to the utilities' post-war employee problems was considered in a meeting of the General Section, under chairmanship of Harry Ferguson, Pennsylvania Power and Light Company. The task of rearranging organizations to absorb returning servicemen and women, many of whom will have had special training fitting them for better jobs than they formerly held, was one of the points under discussion. Carl S. Coler, Pittsburgh District Director, Training Within Industry, War Manpower Commission, outlined the program as carried out by his department.

Representatives of the electrical appliance industry addressed a meeting of the Business Development Section, whose chairman is Austin Monty, Philadelphia Electric Company. The speakers were A. L. Scaife of the General Electric Company and T. J. Newcomb, Westinghouse Electric and Manufacturing Company.

Reports on committee projects gave an overall picture of present technical practices in a meeting of the Engineering Section, H. S. Fitch, West Penn Power Company, chairman. E. C. Stone, Duquesne Light Company, Section Adviser, introduced Lt. Col. Robert C. Downie of the Pittsburgh Ordnance District, Ordnance Department, Army Service Forces, who addressed the meeting on "Industry and the War."

The Accounting Section, with W. H. Judge, West Penn Power Company, presiding, heard E. N. Keller, Manager of Customers' Accounts Division of the Philadelphia Electric Company.

Awards in the fifteenth consecutive Annual Safety Contest sponsored by the association were presented by President McCance. The Pennsylvania Power & Light Company was winner in Group I, comprised of companies employing over 500; Natrona Light & Power took first place among Group II companies, employing less than 500. Winners received plaques and runners-up were awarded certificates of merit.

Contest figures disclosed the fact that the frequency rate of the combined Pennsylvania companies is 44 per cent lower than that of the Electric Utilities Group of the National Safety Council while the severity rate is 12 per cent lower.

Newly elected officers of the Pennsylvania Electric Association are: President, George E. Whitwell, Philadelphia Electric Company; vice-presidents, Francis McQuillin, West Penn Power Company, Pittsburgh; M. H. Parkinson, Pennsylvania Power and Light, and C. F. Nagle, Scranton Electric Company.

The Executive Committee consists of: I. L. Craig, Philadelphia Electric Co.; W. H. Doran, Metropolitan Edison Co., Reading, Pa.; H. S. Fitch, West Penn Power Co., Pittsburgh; G. W. Ousler, Duquesne Light Co., Pittsburgh; E. H. Werner, Pennsylvania Edison Co., Altoona; C. L. Peirce, Jr., Hubbard and Co., Pittsburgh.

PERSONALS

JOSEPH T. FOSTER has been appointed vice-president in charge of real estate and purchases and a director of Public Service Corp. of New Jersey and subsidiary companies, succeeding the late George Barker. ROY S. ROGERS was named purchasing agent to succeed Mr. Foster. Starting with the company in 1914 as a laboratory assistant in the electric department, Mr. Foster was made an assistant engineer in that department three years later. In 1922 he was transferred to the Public Service Production Co. and was named assistant to the vice-president in charge of real estate and purchases, all Public Service companies, in 1927. Later Mr. Foster's title was changed to purchasing agent. A graduate of Syracuse University, Mr. Rogers started with Public Service as a buyer in the purchasing department in 1925.

WAYNE A. DARDEN, for 19 years a member of the Oklahoma Gas & Electric Co., has been made general sales manager to succeed the late Alfred A. Brown.

Mr. Darden, who is 51 years old, was born in Belton, Texas. He is a graduate of Pratt Institute, Brooklyn. Prior to his service with O. G. & E. Co., Mr. Darden was employed by the Texas Power & Light Co. at Dallas.

C. A. LAPPE, for a number of years assistant secretary and assistant treasurer of the Safe Harbor Water Power Corp., Baltimore, Md., has been promoted to the position of secretary and treasurer. A. C. JENSEN, who has long been associated with the company, has been elected assistant secretary and assistant treasurer.

JAMES A. BROWN has been elected vice-president of the Consumers Power Co., Jackson, Mich. Mr. Brown, who has been associated with Consumers and with affiliated companies for 34 years, assumes the place in the organization left vacant when Walter H. Sammis resigned recently to become president of the Ohio Edison Co. With offices in New York he will continue as chief gas engineer for the Commonwealth & Southern Corp. and as president of the Southern Indiana Gas & Electric Co.

E. L. SMITH, acting treasurer of the Superior Water, Light & Power Co., Superior, Wis., has been made treasurer.

LESTER M. SMITH, has been appointed director of public relations of the Alabama Power Co., Birmingham, according to Thomas W. Martin, president of the utility, who announced the establishment of a department of public relations. A native of Alabama and a graduate of the University of Alabama, Mr. Smith has been with the Alabama Power Co. since 1923, having been engaged in engineering work and in the outside activities of the company. For the past year he has given most of his time to the work of the Committee for Economic Development, of which Mr. Martin is regional vice-chairman.

G. V. WILLIAMSON of the Union Electric Co. of Missouri, has been placed in charge of all steam power engineering which comes under the scope of the company's power production division. He heads the new steam operation engineering department, a centralized technical engineering group which will function in the fields of steam plant results, loadings, economy, maintenance technique, plant and equipment developments, chemistry, operating statistics and other related matters.

GEORGE L. HOUSTON, power plant chemist, combustion and results engineer, Central Maine Power Co., Wiscasset, has joined the engineering staff of the United Illuminating Co., New Haven, Conn. He was graduated from the University of Maine in 1937, and before becoming connected with Central Maine Power, was night superintendent, and previously a member of the engineering department of the Atlas Plywood Co., Howland, Me.

BRAYTON D. FISHER has been appointed merchandise sales manager of the Narragansett Electric Co., Providence, R. I., having been sales manager of the Arlington (Mass.) Gas Light Co., another New England Power System affiliate, since 1934. He was born at Worcester, Mass., and was graduated from Norwich University in 1929. Before going to Arlington Mr. Fisher was a sales engineer with the Roberts Gordon Appliance Co., Buffalo, New York, and besides being engaged in the appliance business at Worcester was connected for a short time with the Cambridge (Mass.) Gas & Electric utilities. WILLIAM M. FREUDIGMAN, formerly advertising manager of the Narragansett Electric Co., Providence, R. I., has been appointed assistant merchandise sales manager of that utility.

Three appointments have recently been announced by the Wisconsin Electric Power Co., Milwaukee. JOHN DOCKENDORF has been named secretary and treasurer; F. L. LARKIN vice-president in charge of a newly created department of personnel services and ALFRED GRUHL has been appointed research engineer.

Mr. Dockendorf is an electrical engineering graduate of Iowa State College who was with the American Gas Co. for three years and served in the army in the first world war before joining the Milwaukee utility in 1919 as an engineer in the statistical division. He became research engineer in charge of the operating research bureau in 1941 after having served as assistant research engineer for 10 years. He succeeds Alfred J. Bohl as secretary and treasurer not only of Wisconsin Electric Power Co., but its associated companies, Milwaukee Electric Railway & Transport Co., Wisconsin Gas & Electric Co., and Wisconsin Michigan Power Co.

F. L. Larkin, University of Michigan graduate, was employed in the automotive industry before joining the Wisconsin Electric Power Co. as an engineer in 1925. He was assistant research engineer from 1934 to the time of his recent promotion. The newly organized personnel services department which Mr. Larkin heads will embrace selection and employment of new workers, employee training, accident prevention, labor relations, job evaluation and administration of the company gain-sharing plan.

Mr. Gruhl entered the utility industry as a junior engineer in 1932 from the building industry, becoming assistant research engineer of the Milwaukee company in 1938, the position he held at the time of his recent appointment.

A. W. HOWELL has been named power supervisor of the Union Electric Co., St. Louis, Mo. In this position he will act as chairman of the utility's new oper-

ating committee which consists primarily of heads of operating and engineering groups in the power production division. Committee's chief responsibility will be economic and operating coordination of system production facilities.

G. THEODORE STORB, division commercial manager of the Pennsylvania Power & Light Co. at Lancaster, Pa., has been named manager of the Allentown division to succeed the late George M. Pierce. Mr. Storb has been associated with utilities since 1923 when he became a cadet engineer with the former Edison Electric Co. and the Lancaster Gas, Light & Fuel Co. in Lancaster. He later became statistician and finally was chief engineer for these companies when they were taken over by P. P. & L. He attended Princeton University and Massachusetts Institute of Technology.

Commercial Planning Committee

(*Continued from page* 310)

year period their total capacity will have been increased approximately 24 per cent. This amounts to about 3 per cent per annum compounded and does not exceed the long-term rate of growth of load under normal peacetime conditions.

Since the war began, utility companies have increased their electricity output over 70 per cent. This increase was accomplished in three ways: (1) by longer hours of use of existing capacity as war plants went to two and three shifts; (2) by narrowing the margin between peak load and installed capacity from 40 per cent when the war began to 20 per cent as the war load reached its peak; and (3) by the addition of 15 per cent new generating capacity.

The return to one shift operation will reduce kilowatthour output substantially with relatively little affect on the peak load capacity required. Prudent operating practice and the necessity for periodic overhaul of generating equipment make it desirable to return to the margins between capacity and load which existed in pre-war years as soon as the war emergency is over.

Like other reports in the series, the committee submitted the first one as a contribution to assist those in local electric utility companies who are entrusted with the task of postwar commercial planning. "Such planning is a local task," the reports says, "the central committee can stimulate but there is no substitute for local spade-work."

CONVENTIONS AND MEETINGS

OCTOBER

1-5	National Electrical Contractors Association, French Lick Springs Hotel, French Lick Springs, Ind.
2-3	Prime Movers Committee, EEI, William Penn Hotel, Pittsburgh, Pa.
2-4	Controllers Institute of America, Chicago, Ill.
3-5	National Safety Congress of National Safety Council, Chicago, Ill.
5	American Gas Association, Engineers Societies Building, New York, N. Y.
5-6	Electrical Equipment Committee, EEI, Schenley Hotel, Pittsburgh, Pa.
9-10	Transmission and Distribution Committee, EEI, Hotel Statler, Buffalo, N. Y.
11	Advisory Committee, EEI, Hotel Biltmore, New York, N. Y.
18	Post War Planning Committee, EEI, William Penn Hotel, Pittsburgh, Pa.
19	Industrial Relations Committee, EEI, New York, N. Y.
19-20	Pennsylvania Electric Association, Electrical Equipment Committee, Johnstown, Pa.
23-27	National Electrical Manufacturers Association, Waldorf-Astoria Hotel, New York, N. Y.
25-27	Rate Research Committee, EEI, Hotel Warwick, Philadelphia, Pa.

NOVEMBER

9-10	Southeastern Electric Exchange, Advertising and Sales Conference, Henry Grady Hotel, Atlanta, Ga.
27-30	American Society of Mechanical Engineers, Pennsylvania Hotel, New York, N. Y.

JANUARY, 1945

22-26	American Institute of Electrical Engineers, Engineering Societies Building, New York, N. Y.

Farm Line Extensions by Electric Utility Companies When WPB Limitations Are Withdrawn

PRIVATELY operated electric utilities are planning to extend their lines to slightly over one half million farms in the three year period following withdrawal of WPB limitations on line constructions, according to a survey made this summer by the Edison Electric Institute. An additional 350,000 customers may also be expected to be added in non-farm homes in rural areas. The following table shows the distribution by geographic divisions of farms to be connected.

Geographical Divisions	*Farms To Be Connected* 1944-45	1946	1947	*Total*
New England	12,000	8,000	6,000	26,000
Middle Atlantic	24,000	12,000	9,000	45,000
East North Central	40,000	25,000	19,000	84,000
West North Central	22,000	17,000	16,000	55,000
South Atlantic	46,000	42,000	37,000	125,000
East South Central	24,000	34,000	17,000	75,000
West South Central	34,000	24,000	17,000	75,000
Mountain	6,000	2,000	1,000	9,000
Pacific	12,000	8,000	6,000	26,000
	220,000	172,000	128,000	520,000
Expected rural non-farm homes to be added along same lines				350,000
				870,000

Estimated miles of line for the 520,000 farm customers	=	152,000
Estimated cost for the 520,000 farm customers	=	$205,000,000
Estimated cost for the 350,000 non-farm customers	=	$ 45,000,000
		$250,000,000

The estimated number of unserved farms in the franchise areas served by all electric utility companies was 1,745,000 at the time of the survey. Thus, in the next three years the companies would add to their lines 30 per cent of these and would bring the total number of farms served by them to 2,120,000.

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